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Culture and Cognition : The Relationship between Self- Construals and Cognitive Fluency

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Culture and Cognition: The Relationship between Self-Construals and Cognitive Fluency

A dissertation submitted in partial satisfaction of the
Requirements for the degree Doctor of Philosophy

in

Clinical Psychology

by

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The Dissertation of Luis D. Medina is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California, San Diego

San Diego State University

2015

DEDICATION

I dedicate this to the memory of my grandmother, Aurelia “Delia” Flores,

who pushed me to explore my personal best,

encouraged me to challenge limits, and

inspired me to go beyond expectations.

I wish you were still here with us.

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LIST OF ABBREVIATIONS

IC	Self-construal individualism collectivism
YA	Young adults
OA	Older adults
LPA	Latent profile analysis
SDSU	San Diego State University
UCSD	University of California, San Diego

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Medina, L. D. (2005). Metamemory in preclinical familial Alzheimer's disease. National Institutes of Health Diversity Supplement. Dates of support: 6/06-6/08

Medina, L. D. (2012). Inamori Fellowship, Dr. Kazuo Inamori Fellowship Program. Dates of Support: 1/12-12/12

Medina, L. D. (2010). Predoctoral Fellowship, National Research Council – Ford Foundation. Dates of support: 9/10-8/11

Medina, L. D. (2009). San Diego Fellowship, University of California, San Diego. Dates of support: 9/09-8/11.

PUBLICATIONS

Flores-Medina, Y., Chavez-Oliveros, M., Medina, L. D., Rodriguez-Agudelo, Y., & Solis-Vivanco, R. (2014). Brain lateralization of complex movement: Neuropsychological evidence from unilateral stroke. *Brain and Cognition, 84*, 164-169. doi: 10.1016/j.bandc.2013.11.010

Hooper, M., Grill, J. D., Rodriguez-Agudelo, Y., Medina, L. D., Fox, M., Alvarez-Retuerto, A. I., Wharton, D., Brook, J., & Ringman, J. M. (2013). The impact of the availability of prevention studies on the desire to undergo predictive testing in persons at risk for autosomal dominant Alzheimer's disease. *Contemporary Clinical Trials*. doi:10.1016/j.cct.2013.07.006

Medina, L. D., Pirogovsky, E., Salomonczyk, D., Goldstein, J., Panzera, R., Gluhm, S., Simmons, R., Corey-Bloom J., & Gilbert, P. E. (2013). Postural limits of stability in premanifest and manifest Huntington's disease. *Journal of Huntington's Disease, 2*, 177–184. doi:10.3233/JHD-130048

Lee, G. J., Lu, P. H., Medina, L. D., Rodriguez-Agudelo, Y., Melchor, S., Coppola, G., Braskie, M.N., Apostolova, L.G., Leow, A., Thompson, P.M., & Ringman, J. M. (2013). Regional brain volume differences in symptomatic and presymptomatic carriers of familial Alzheimer's disease mutations. *Journal of Neurology, Neurosurgery, and Psychiatry, 84*, 154–162. doi:10.1136/jnnp-2011-302087

Braskie, M. N., Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Macias-Islas, M. A., Cummings, J. L., Bookheimer S.Y., & Ringman, J. M. (2012). Increased fMRI signal with age in familial Alzheimer's disease mutation carriers. *Neurobiology of Aging, 33*, 424.e11–21. doi:10.1016/j.neurobiolaging.2010.09.028

Braskie, M. N., Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Macias-Islas, M. A., Thompson, P. M., Cummings, J. L., Bookheimer, S. Y., & Ringman, J. M. (2012). Memory performance and fMRI signal in presymptomatic familial Alzheimer's disease. *Human Brain Mapping*. doi:10.1002/hbm.22141

Medina, L. D., & Rodríguez Agudelo, Y. (2012). Impedimento cognoscitivo en demencias. [Cognitive impairment in dementias]. *Journal of Behavior, Health & Social Issues, 4*, 37–44. doi:10.5460/jbhsi.v4.2.34106

Ringman, J. M, Coppola, G., Elashoff, D., Rodriguez-Agudelo, Y., Medina, L. D., Gylys, K., Cummings, J. L., & Cole, G. M. (2012). Cerebrospinal fluid biomarkers and proximity to diagnosis in preclinical familial Alzheimer's disease. *Dementia and Geriatric Cognitive Disorders, 33*, 1–5. doi:10.1159/000335729

Apostolova, L. G., Hwang, K. S., Medina, L. D., Green, A. E., Braskie, M. N., Dutton, R. A., Lai, J., Geschwind, D. H., Cummings, J. L., Thompson, P. M., & Ringman, J. M. (2011). Cortical and hippocampal atrophy in patients with autosomal dominant familial Alzheimer's disease. *Dementia and Geriatric Cognitive Disorders, 32*, 118–125. doi:10.1159/000330471

Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Gilbert, P. E., Liang, L.-J., Cummings, J. L., & Ringman, J. M. (2011). Propositional density and apolipoprotein E genotype among persons at risk for familial Alzheimer's disease. Dementia and Geriatric *Cognitive Disorders, 32*, 188–192. doi:10.1159/000333023

Ringman, John M, Gylys, K. H., Medina, L. D., Fox, M., Kepe, V., Flores, D. L., Apostolova, L. G., Barrio, J., Small, G., Silverman, D. H., Siu, E., Cederbaum, S., Hecimovic, S., Malnar, M., Chakraverty, S., Goate, A. M., Bird, T. D., & Leverenz, J. B. (2011). Biochemical, neuropathological, and neuroimaging characteristics of early-onset Alzheimer's disease due to a novel PSEN1 mutation. *Neuroscience Letters, 487*, 287–292. doi:10.1016/j.neulet.2010.10.039

Ringman, J. M., Medina, L. D., Braskie, M., Rodriguez-Agudelo, Y., Geschwind, D. H., Macias-Islas, M. A., Cummings, J. L., & Bookheimer, S. (2011). Effects of risk genes on BOLD activation in presymptomatic carriers of familial Alzheimer's disease mutations during a novelty encoding task. *Cerebral Cortex, 21*, 877–883. doi:10.1093/cercor/bhq158

Golob, E. J., Ringman, J. M., Irimajiri, R., Bright, S., Schaffer, B., Medina, L. D., & Starr, A. (2009). Cortical event-related potentials in preclinical familial Alzheimer disease. *Neurology, 73*, 1649–1655. doi:10.1212/WNL.0b013e3181c1de77

Ringman, J. M, Medina, L. D., Rodriguez-Agudelo, Y., Chavez, M., Lu, P., & Cummings, J. L. (2009). Current concepts of mild cognitive impairment and their applicability to persons at-risk for familial Alzheimer's disease. *Current Alzheimer Research, 6*, 341–346.

Ringman, J. M., Younkin, S. G., Pratico, D., Seltzer, W., Cole, G. M., Geschwind, D. H., Geschwind, D. H., Rodriguez-Agudelo, Y., Schaffer, B., Fein, J., Sokolow, S., Rosario, E. R., Gylys, K. H., Varpetian, A., Medina, L. D., & Cummings, J. L. (2008). Biochemical markers in persons with preclinical familial Alzheimer disease. *Neurology, 71*, 85–92. doi:10.1212/01.wnl.0000303973.71803.81

Ringman, J. M., Romano, J. D., Medina, L. D., Rodriguez-Agudelo, Y., Schaffer, B., Varpetian, A., Ortiz, F., Fitten, L. J., Cummings, J. L., & Baloh, R. W. (2008). Increased prevalence of significant recurrent headache in preclinical familial Alzheimer's disease mutation carriers. *Dementia and Geriatric Cognitive Disorders, 25,* 380–384. doi:10.1159/000121986

Ringman, J. M., O'Neill, J., Geschwind, D., Medina, L., Apostolova, L. G., Rodriguez, Y., Schaffer, B., Varpetian, A., Apostolova, Y., Tseng, B., Ortiz, F., Fitten, J., Cummings, J.L., & Bartzokis, G. (2007). Diffusion tensor imaging in preclinical and presymptomatic carriers of familial Alzheimer's disease mutations. *Brain, 130,* 1767–1776. doi:10.1093/brain/awm102

Murrell, J., Ghetti, B., Cochran, E., Macias-Islas, M. A., Medina, L., Varpetian, A., Cummings, J. L., Mendez, M. F., Kawas, C., Chui, H., & Ringman, J. M. (2006). The A431E mutation in PSEN1 causing familial Alzheimer's disease originating in Jalisco State, Mexico: an additional fifteen families. *Neurogenetics, 7,* 277–279. doi:10.1007/s10048-006-0053-1

Lee, P., Medina, L., & Ringman, J. M. (2006). The Thr354Ile substitution in PSEN1: Disease-causing mutation or polymorphism? *Neurology, 66,* 1955–1956. doi:10.1212/01.wnl.0000219762.28324.a6

PRESENTATIONS

<u>Paper Presentations</u>

1. Medina, L. D., Gilbert, P., Pirogovsky, E., Roesch, S., Goldstein, J., Rosenblatt, A., Dubinsky, R., & Cody-Bloom, J. (2011). *Memantine in Huntington's disease: A randomized, double-blind, placebo-controlled pilot study.* American Academy of Neurology Annual Meeting. Honolulu, HI
2. Medina, L. D., Gilbert, P., Roesch, S., Goldstein, J., Pirogovsky, E., Rosenblatt, A., Dubinsky, R., & Corey-Blum, J. (2010). *A randomized, double-blind, placebo-controlled pilot study of memantine in Huntington's disease.* Huntington Study Group's Huntington Disease Clinical Research Symposium. La Jolla, CA
3. Medina, L. D., Woo, E., Rodriguez, Y., Cummings, J. L., & Ringman, J. (2009). *Metamemory in familial Alzheimer's disease mutation carriers.* International Neuropsychological Society Annual Meeting. Atlanta, GA.

<u>Poster Presentations</u>

Medina, L. D., De Leon, F., Rodriguez, G., Evans, J., Wright, M. J., Apostolova, L. G., Ringman, J., & Woo, E. (2015). *The impact of dysexecutive symptoms on prospective memory in healthy aging, mild cognitive impairment, and dementia*. International Neuropsychological Society Annual Meeting. Denver, CO.

Medina, L. D., Seewald, M., Becerra Cuellar, D. C., Sadler, M. S., Filoteo, J. V., & Gilbert, P. E. (2014). *Self-construal as a predictor of cognitive abilities in healthy aging*. International Neuropsychological Society Annual Meeting. Seattle, WA.

Myers, C., Simon, J., Wharton, D., Medina, L., Alvarez-Retuerto, A. I., Coppola, G., Gluck, M., & Ringman, J. (2013). *Impaired generalization of acquired memory pairings in preclinical familial Alzheimer's disease (FAD) mutation carriers*. American Academy of Neurology Annual Meeting. San Diego, CA.

Medina, L. D., Gracian, E., Pirogovsky, E., Brusati, G., Gluhm, S., Bloom, B., Woods, S. P., Filoteo, V., & Gilbert, P. E. (2013). *Prospective memory relates to everyday functioning in older adults but not in younger adults.* International Neuropsychological Society Annual Meeting. Waikoloa, HI.

Medina, L. D., Nguyen, P., Teng, E., Lu, P. H., Wright, M. J., Apostolova, L., Hwang, K., Babakchanian, S., & Woo, E. (2011). *Memory strategy use in mild cognitive impairment and Alzheimer's disease*. Alzheimer's Association International Conference. Paris, France.

Grill, J., Hooper, M., Rodriguez-Agudelo, Y., Medina, L., & Ringman, J. (2011). *The influence of the availability of prevention trials on genetic testing decisions in persons at-risk for familial Alzheimer's disease.* American Academy of Neurology Annual Meeting. Honolulu, HI.

Braskie, M. N., Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Macias-Islas, M. A., Thompson, P. M., Bookheimer, S. Y., & Ringman, J. M. (2011). *Increased fMRI signal may indicate neuronal failure in pre-clinical familial Alzheimer's disease mutation carriers.* American Academy of Neurology Annual Meeting. Honolulu, HI.

Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Gilbert, P., Cummings, J. L., &Ringman, J. M. (2011). *Familial Alzheimer's disease and propositional density: The Nun Study revisited*. International Neuropsychological Society Annual Meeting. Boston, MA.

Apostolova, L. G., Hwang, K. S., Medina, L. D., Green, A. E., Dutton, R. A., Lai, J., Cummings, J. L., Thompson, P. M., & Ringman, J. M. (2010). *Mapping cortical thickness in autosomal dominant AD carriers*. American Academy of Neurology Annual Meeting. Toronto, ON.

Woo, E., Medina, L. D., Rodriguez-Agudelo, Y., Yi, D., Coppola, G., Cummings, J.L., & Ringman, J. M. (2010). *Attention and Working Memory in Familial Alzheimer's Disease*. International Conference on Alzheimer's Disease. Honolulu, HI.

Nunez, C., Cagigas, X. E., Medina, L. D., Rodriguez-Agudelo, Y., Yi, D., Coppola, G., Cummings, J. L., & Ringman, J. M. (2010). *Neuropsychological performance and demographic variables predict familial Alzheimer's disease genetic status in a Spanish speaking simple.* International Conference on Alzheimer's Disease. Honolulu, HI.

Braskie, M. N., Medina, L. D., Rodriguez-Agudelo, Y., Geschwind, D. H., Macias-Islas, M.A., Cummings, J. L., Bookheimer, S. Y., Ringman, J. M. (2010). Increased *fMRI activity with age in left temporal lobe of familial Alzheimer's disease mutation carriers.* International Conference on Alzheimer's Disease. Honolulu, HI.

Lu, P., Lee, G. J., Thompson, P. M., Medina, L., Leow, A., Coppola, G., Cummings, J. L., Ringman, J. M. (2010). *A tensor-based morphometry study of brain volume changes in symptomatic and pre-symptomatic patients with familial Alzheimer's disease*. International Conference on Alzheimer's Disease. Honolulu, HI.

Flores, D. L., Liang, L., Medina, L. D., Rodriguez Agudelo, Y., Schaffer, B., Macias-Islas, M. A., Fitten, L. J., Ortiz, F., Cummings, J. L., & Ringman, J. M. (2009). *Behavioral disturbances in early familial Alzheimer's disease*. International Conference on Alzheimer's Disease. Vienna, Austria.

Chen, A. H., Medina, L. D., & Ringman, J. M. (2009). *FMRI of pre-symptomatic familial Alzheimer's disease (FAD) mutation carriers during a task of executive function*. Annual Meeting of the American Geriatrics Society. Chicago, IL.

Ringman, J. M., Medina, L., Rodriguez, Y., Schaffer, B., Varpetian, A., Macias-Islas, M. A., Cummings, J. L., & Bookheimer, S. (2008). *Decreased activation in the left medial parietal lobe in presymptomatic FAD mutation carriers in fMRI during an unrelated word pair memory task.* International Conference on Alzheimer's Disease. Chicago, IL.

Ringman, J. M., Seltzer, W., Cole, G., Medina, L. D., Rodriguez, Y., Fitten, J., Ortiz, F., & Cummings, J. L. (2008). *CSF p-tau*$_{181}$*, total-tau, and p-tau*$_{181}$*/t-tau ratio in pre-symptomatic familial Alzheimer's disease.* American Academy of Neurology Annual Meeting. Chicago, IL.

Medina, L.D., Lu, P., Rodriguez, Y., Cummings, J. L., & Ringman, J. (2008). *Memory self-appraisal and actual memory performance in mutation carriers for familial Alzheimer's disease.* International Neuropsychological Society Annual Meeting. Waikoloa, Hawaii.

Medina, L. D., Lu, P., Rodriguez, Y., Ortiz, F., Fitten, J., Geschwind, D., Schaffer, B., Cummings, J. L., & Ringman, J. (2008). *The Wisconsin Card Sorting Test in presymptomatic familial Alzheimer's disease mutation carriers.* International Neuropsychological Society Annual Meeting. Waikoloa, Hawaii.

Flores, D., Medina, L. D., Rodriguez, Y., Geschwind, D., Schaffer, B., Fitten, J., Ortiz, F., Cummings, J. L., & Ringman, J. (2008). *Premorbid psychiatric abnormalities are not common in presymptomatic familial Alzheimer's disease gene carriers*. International Neuropsychological Society Annual Meeting. Waikoloa, Hawaii.

Medina, L., Rodriguez, Y., Cummings, J. L., & Ringman, J. (2007). *Metamemory correlates in persons at-risk for familial Alzheimer's disease.* American Academy of Neurology Annual Meeting. Boston, MA.

Ringman, J. M., Dutton, R. A., Lai, J. C., Medina, L., Apostolova, L., Cummings, J. L., Thompson, P. (2007). *Cortical thinning detected and visualized in the preclinical phase of familial Alzheimer's disease*. American Geriatrics Society Annual Meeting, Seattle, WA.

Ringman, J. M., Cole, G., Geschwind, D., Shaffer, B., Rodriguez, Y., Fein, J., Medina, L., Pratico, D., Younkin, S., & Cummings, J. L. (2006). *Biochemical markers in blood and cerebrospinal fluid of persons with or at-risk for familial AD.* International Conference on Alzheimer's Disease (ICAD). Madrid, Spain

Ringman, J. M., O'Neill, J., Tseng, P. B., Apostolova, L., Geschwind, D., Shaffer, B., Rodriguez, Y., Medina, L., Cummings, J. L., & Bartzokis, G. (2006). *Decreased fractional anisotropy in the fornix of presymptomatic carriers of FAD mutations.* International Conference on Alzheimer's Disease (ICAD). Madrid, Spain

Ringman, J. M., O'Neill, J., Tseng, P. B., Geschwind, D., Shaffer, B., Rodriguez, Y., Medina, L., & Cummings, J. L. (2006). *Elevated hippocampal myo-inositol in subjects with or at-risk for familial AD.* International Conference on Alzheimer's Disease (ICAD). Madrid, Spain

Medina, L. D., Tolentino, J, Jimenez, E., Ruiz, G., Cummings, J., & Ringman, J. (2006). *Verbal fluency, propositional density, and literacy in persons at-risk for familial AD.* UC Los Angeles Research Conference on Aging. Los Angeles, CA

Medina, L., Mennin, D., & Kaufman, J. (2004). *Anxiety, trauma, and emotion regulation in a child sample.* Stanford Undergraduate Psychology Conference (SUPC). Palo Alto, CA

ABSTRACT OF THE DISSERTATION

Culture and Cognition: The Relationship between

Self-Construals and Cognitive Fluency

by

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Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2015

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Neuropsychological research has been limited in representation of cultural diversity due to various issues. These limitations raise questions regarding applicability of current findings to diverse populations. Nonetheless, culture-dependent differences in fundamental psychological processes have been demonstrated in several domains. One

of the most basic of these, self-construal, is central to how many other differences are interpreted. Self-construals, described as individualistic or collectivistic (IC), may have possible consequences on social interactions, emotions, motivation, and cognition. Despite research demonstrating cultural differences, frontal-lobe-dependent cognitive processes are not well understood in the context of self-construal. This dissertation explored this relationship.

A total of 201 adults (101 young, 100 older) were recruited. The young adults (YA) were recruited from undergraduate psychology students between ages 18 and 26. The older adults (OA) were community-dwelling and at least 60 years of age.

IC was measured using common three self-report measures. A brief neuropsychological battery was administered to assess for verbal and non-verbal fluency abilities. The study aimed to: (1) demonstrate the usefulness of Latent Profile Analysis (LPA) in classification of IC when using multiple measures of self-construal; (2) evaluate the impact of self-construal on cognitive fluency; (3) elucidate the effect of aging on this relationship.

Once participants were classified by self-construal based on LPA results, one-way analyses of covariance (ANCOVA) including relevant covariates (e.g., gender, ethnicity, education) were usedto compare cognitive performance between individualists and collectivists in both age groups. In YA, self-construal was not significantly related to cognitive performance (all ps>.05). In OA, collectivists outperformed individualists on measures of verbal fluency after controlling for race, ethnicity, and linguistic abilities. Groups did not differ on non-verbal fluency.

Results support the utility of LPA in assessing self-construal. Although self-construal did not affect cognitive performance in YA, cross-cultural differences emerged in OA. This bias may be due to a cognitive advantage in collectivists for executive function as measured by verbal fluency. Research with more diverse samples and larger cognitive batteries is needed to clarify relationships among self-construal, cognition, and age and to explore the possible role of executive functions. Nonetheless, self-construal as a key demographic factor may provide a meaningful descriptor for diverse samples in neuropsychological research.

INTRODUCTION

Cultural diversity continues to change and grow at both a nationwide and global scale, facilitated by newer and affordable forms of transportation and motivated by socioeconomic factors integral to the emigration/immigration process. In the United States of America alone, both the population of Asians as well as that of Hispanics/Latinos living in the country have each increased 43 percent between the period of 2000 and 2010. Additionally, the population of individuals who identified as being of more than one race increased during this same ten-year span by 32 percent (US Census Bureau, 2010).

Despite apparent cultural differences and the implications of this diversity, the scientific literature, including that in the field of psychology, has been limited in its representation of cultural diversity due to numerous factors. An example of this was presented in a review of neuropsychological research journals that spanned over five years. Although age, education, and gender were frequently reported in these publications, race, ethnicity, native language, and acculturation were rarely, if ever, included in the description of research samples (O'Bryant, O'Jile, & McCaffrey, 2004). In addition to this shortcoming, issues related to the recruitment of underrepresented populations (Sheikh, 2006) have further raised questions regarding the applicability of current research findings to these populations (Cagigas, 2008). Therefore, it is paramount for current research to consider the role of cultural factors on established norms and newly found empirical results.

Another complication to issues regarding cultural factors in scientific research revolves around classification taxonomies intended to distinguish between groups. Varied constructs referring to race, ethnicity, culture, and other demographic variables often are used inconsistently or in ways that reduce statistical power to make confident inferences from research results. Nonetheless, underrepresented minorities report willingness to participate in health research comparable to that of non-Hispanic whites, leading to suggestions in increasing minority participation and a focus on ensuring access for all groups (Wendler et al., 2006).

Previous Research on Cultural Differences

In essence, "culture" is defined as relating to both internal and external factors. It is a particular system of beliefs and values associated with customs, norms, practices, and social institutions (Fiske, Kitayama, Markus, & Nisbett, 1998). Culture is fluid and dynamic (American Psychological Association, 2002) and describes diversity via multiple pathways (e.g., race, ethnicity, nationality, gender, age socioeconomic status, religion, disability). Kitayama and Park (2010) further explain that culture has three main constituents: explicit values, cultural tasks intended to achieve the culture's primary values, and the implicit psychological and neural tendencies aligning with those values. It is theorized that both micro (biological) and macro (behavioral) aspects of culture are associated with brain processes that plastically change as a function of an individual's engagement in culture-specific ideas and practices, illustrating a model of a neuro-cultural interaction (Kitayama & Uskul, 2011). In other words, given that culture involves explicit behaviors and processes, synchronous firing of neurons during cultural tasks results in those neurons being wired together; therefore, cultural tasks can shape and modify neural pathways (Kitayama & Park, 2010).

Culture-dependent differences in fundamental psychological processes have been demonstrated in various domains (Chiao & Ambady, 2007). For example, researchers have examined cultural variation in the context of such dimensions as religiosity (Cohen & Rozin, 2001), hierarchy (Shavitt, Torelli, & Riemer, Forthcoming), and honor (Nisbett & Cohen, 1996). However, one of the most basic cultural dimensions, how people perceive the self, has been central to how many of these other differences are interpreted and explained. Described as construals of the self that are either independent (or *individualistic*) or interdependent (or *collectivistic*), the development of self-perception can be traced to early childhood and parental rearing practices, ultimately being further reinforced by peers and society. Self-construals of individualism or collectivism (IC) have been implied as having possible consequences not only on social roles and interactions, but also on emotions, motivation, and cognition (Markus & Kitayama, 1991). It has been hypothesized that some cultural differences observed in adult competencies, such as those measured by level of autonomy, willingness to communicate with partners, and realistic versus idealized assessment of others, may potentially be due to developmental differences in areas such as exploration, autonomy, and efficacy (Rothbaum, Weisz, Pott, Miyake, & Morelli, 2000). Indeed, researchers have found evidence of cultural differences between individualists and collectivists in the use of socially engaging and disengaging emotions, regulation of emotions, and intrinsic versus extrinsic motivation (see Kitayama & Park, 2010 for a review).

Much of the research on involving self-construal and relevant cultural differences has relied on a fairly consistent "East-West" paradigm. Western cultures, described as a highly individualist, tend to place greater value on the personal self, applying a schema of independence to social perception, and grounding their emotional life and motivation primarily on personal goals, desires, and needs. On the other hand, Easter cultures, which are seen as highly collectivist, place greater value on their interpersonal or social self, applying this schema to their social perception, and grounding their emotions and motivations largely on social goals and concerns (Kitayama & Park, 2010).

The individual development of cognition and meaning systems takes place in a cultural context through the interactions with other people (Cole & Means, 1986; Cole, 1989). These different culture-dependent meaning systems may then alter genomic expression and neural processing (Chiao & Ambady, 2007). Epigenetic literature has brought to light the influence of ecology and culture on such genetic factors as single-nucleotide polymorphism (SNPs). In one example, attention deficit hyperactivity disorder and novelty seeking have been linked to long allelic version of dopamine receptor gene 4 (DRD4), a genetic variant commonly found in European Americans, typically seen as a more individualistic culture, but virtually absent in Asians, a collectivist culture (Chen, Burton, Greenberger, & Dmitrieva, 1999). In a similar study of genetic coevolution across 29 nations, one group found a correlation between allelic frequency of the serotonin transporter functional polymorphism (5-HTTLPR) and collectivism (Chiao & Blizinsky, 2010). A higher frequency of the 5-HTTLPR short allele, known to be a risk factor for depression, was shown in countries classified as being more collectivistic, where perhaps the genetic factor is adaptive. That is, the shorter allele in a collectivistic environment with strong social links, and subsequent strong psychological support, would be more adaptive than in an individualistic environment.

Using a functional magnetic resonance imaging (fMRI) protocol, one study that examined social conformity during a mental rotation task found functional changes in several brain regions that differed between participants who were conforming to peer responses, defined as a collectivist pattern, and those who were not, defined as an individualist pattern (Berns et al., 2005). Tang and colleagues (2006) found differential cortical representations and functional distinctions on fMRI connectivity in pre-motor cortex and perisylvian cortices between individualists and collectivists when processing arithmetic. During an attention task, another fMRI study found frontal-parietal activation differences between East Asians and Americans of Western European ancestry (Hedden, Ketay, Aron, Markus, & Gabrieli, 2008). As described by Zhu and colleagues, neural processing of the self and self-reference judgment is associated with greater activation in the medial prefrontal cortex (mPFC) in both cultural groups (Zhu, Zhang, Fan, & Han, 2007). Similar patterns of activation in the mPFC have been found by others (e.g., Chiao et al., 2009, 2010; Harada, Li, & Chiao, 2010). Therefore, this evidence supports the notion that self-construal is a higher order function potentially mediated by frontal lobe processes.

This association with the frontal lobe has been demonstrated in other imaging research. A psychophysiological study utilizing event-related potentials (ERP) specific to frontal-parietal regions during a serial-order recall task similarly found differential recruitment of neurocognitive resources (Goode, Goddard, & Pascual-Leone, 2002). In a sample of 5-year-olds using ERP, individualists and collectivists performed similarly on an inhibition tasks but revealed distinct activation patterns (Lahat, Todd, Mahy, Lau, & Zelazo, 2010). Moreover, collectivists have demonstrated greater intensity in the novelty P3 ERP when detecting novel stimuli in an oddball paradigm (Lewis, Goto, & Kong, 2008) and are more prone to detect incongruity than individualists as shown by the N400 ERP (Goto, Yee, Lowenberg, & Lewis, 2013). Taken together with other imaging research, individualists and collectivists not only use the same part of the brain in different ways, but also employ different parts of the brain to achieve the same goal (Miller & Kinsbourne, 2012). Based on these basic cross-cultural differences, cultural psychologists have described cognition as not simply *influenced by* culture, but rather, cognition as essentially *defined by* culture through pathways of IC (Greenfield, Keller, Fuligni, & Maynard, 2003).

Besides physiological differences noted during cognitive tasks, other research has focused on functional differences in neuropsychological performance in the context of IC. Memory has been described as being context bound and, therefore, potentially sensitive to cultural differences (Mistry & Rogoff, 1994). One group studying cognitive function across the life span in both China, a collectivist country, and in the United States, an individualist country, found no evidence of cultural differences in non-verbal tasks of working memory with a visuospatial component (Hedden et al., 2002). However, results on a verbal task of working memory (Digit Span – Backward) were saturated with cultural differences with Chinese participants performing significantly better than their American counterparts. On the contrary, another group using a brief cognitive measure found evidence of differences in both verbal and nonverbal measures.

Whereas overall performance on the measure was the same in both groups, Finnish elderly, individualists, outperformed Chinese elderly on copying of a figure but underperformed in recalling words (Salmon et al., 1989). Such mixed findings have led many to argue the relationship between language and observed cognitive differences.

Linguistic relativity hypothesis (Whorf, 1956) argues that since language influences cognition, these cultural differences are, therefore, a product of language differences. Although support for the impact of language on thought is strong (Hunt & Agnoli, 1991), more recent research suggests cultural differences on cognition go beyond the mere impact of language (Ji, Zhang, & Nisbett, 2004). However, limited test batteries make it difficult to draw inferences on how culture may affect general performance in cognitive domains rather than on few tests of these domains. Moreover, language and translation issues have made it difficult to evaluate the extent to which culture impacts performance on these measures beyond the mere effect of language. For instance, in a study of 161 patients referred to a neuropsychology clinic, poorer performance on some cognitive measures were accounted by language first spoken, while acculturation and years living in the United States accounted for poorer performance on other measures (Boone, Victor, Wen, Razani, & Pontón, 2007). Another study found a relationship between bilingualism and short-term memory (Kaushanskaya, Blumenfeld, & Marian, 2011), demonstrating the need to account for language in the evaluation of cultural differences in cognition. As described by Rosselli and Ardila (2003), the idea of “culture-free” tests appears to be only an illusion.

While attempting to control for language, many studies have focused on how cultures differ on less language-sensitive measures of attention and visual-spatial perception. Using eye-tracking equipment, one group found differences in the eye movements of Chinese participants and American participants while viewing photographs (Chua, Boland, & Nisbett, 2005). In this study, Chinese participants, who focused more on background information, took longer to attend to the focal object in the photo than the American participants, who tended to fixate on the focal object before gazing at the background. This is consistent with other evidence showing that collectivists tend to be more field-dependent, focusing more on the background and field, whilst individualists tend to be more field-independent, fixating more on the foreground and focal elements of a scene (Berry & Annis, 1974; Eagle, Goldberger, & Breitman, 1969; Nisbett, Peng, Choi, & Norenzayan, 2001; Witkin & Berry, 1975; Witkin & Goodenough, 1977). This propensity to attend differently to visual stimuli appears to be related as well to how individualists and collectivists differentially detect change in focal objects or in their context, a concept referred to as "change blindness" (Simons & Levin, 1997), and to their respective selection and incorporation of information in the decision-making process (Ji, Peng, & Nisbett, 2000; Masuda & Nisbett, 2001). Likewise, context dependent and independent patterns have been noted even when collectivists and individualists describe themselves (Cousins, 1989; Rhee, Uleman, Lee, & Roman, 1995).

In a study using category learning tasks, Cagigas (2008) reported evidence that cultural differences on cognitive measures may be more attributable to higher cortical functions than more primitive subcortical systems. This may help explain extant literature on executive functions and culture. Prior research has shown that children in Japan, a collectivist culture, develop theory of mind, a higher order executive function, later than Western children (Naito, 2003). Asian children, nonetheless, tend to outperform North American and British children on various inhibition, cord sorting, and tower-building tasks believed to be related to these higher order cortical processes (Chen et al., 1998; Sabbagh, Xu, Carlson, Moses, & Lee, 2006). Coupled with evidence from physiological research demonstrating differences in frontal lobe processes between individualists and collectivists and the implications from the reported neuropsychological research on attention, an argument can be made that behavioral manifestations of frontal-lobe dependent cognitive processes exist between collectivists and individualists. The current dissertation sought to explore this relationship.

Why Examine Culture and Cognition through Self-Construal

As noted previously, the use of constructs such as race, ethnicity, nationality, and other related demographic variables can complicate cross-cultural research by narrowing groups and, thusly, impacting statistical power to make inferences. Additionally, such labels create clear distinctions that do not account for individuals who effectively blur the lines between categories. For instance, this can be seen in individuals with dual-citizenship, individuals of one racial background who were reared by parents of a different racial background, or in persons who identify as being members of more than one group (Arnett, 2002). Some argue that this type of categorizing lends itself to seeing culture-specific, “emic” (Lonner & Berry, 1986) attributes as differentiating members of contrasting cultures rather than using a more “pan-cultural” approach (Bochner, 1994) that allows for the clustering of cultures based on an underlying perceptual process instead of arbitrary distinctions. Along those lines, others have argued that racial categories lack conceptual meaning when principles of the scientific method are applied

(Helms, Jernigan, & Mascher, 2005) and that perhaps constructs like self-construal may provide more understanding in the study of underlying cultural differences (Cagigas, 2008).

The use of self-construal in the conceptualization of culture has another advantage. Most often, research that attempts to report or account for cultural diversity utilizes predetermined "check-box" classifications, such as race or ethnicity, where an individual is asked to check off a box that most closely describes how the person identifies him-/herself. On the other hand, self-construal can be evaluated through the use of various objective measures. Such measures can then provide information to either categorize the individual along a binary system (i.e., collectivist *or* individualist) or a continuum describing the extent to which each is manifested within the individual (i.e., *how* collectivistic *and* individualistic). The latter approach capitalizes on how the two may not be mutually exclusive in an individual. Other recommendations for further categorization of self-construal have been suggested, but are beyond the scope of this dissertation (see Triandis, 1998).

Markus and Kitayama (1991) describe suggestions made by past research as to how independence or interdependence may pull cognitive resources differently. Individuals from collectivist cultures, who focus on the respect and obedience of others, potentially expend cognitive capacity that might be devoted to a task, such as an executive function task. This possibly explains why norms for some creativity tasks, a higher-order ability attributed greatly to frontal lobe processes, in collectivist Chinese populations fall below American norms. However, research into this hypothesized restriction of available cognitive resources dependent on self-construals is limited. In a series of executive function studies conducted on college students, one research team found evidence of increased difficulty in a problem-solving task due to increased cognitive load based on active choice and response (Lieberman, Jarcho, & Obayashi, 2005). Another study described differences in reasoning and logic, other frontal lobe mediated higher-order abilities, dependent on self-construals where collectivists were more likely to be holistic in their cognition and rely on dialectical reasoning whilst individualists were prone to analytic cognition and formal logic (Nisbett et al., 2001; Varnum, Grossmann, Kitayama, & Nisbett, 2010). In a similar study, one group (Na et al., 2010) found evidence that although these cognitive style differences can help distinguish between individualists and collectivists at the group level, these differences are less valid at the individual level. However, these studies focus on tasks that measure mode of thought and not specific neuropsychological functional domains. In other words, assessment of mode of thought (e.g., analytic attention, naïve dialecticism, causal inference), although higher order, evaluates processes attributed to or mediated by various brain regions and functional domains. Therefore, without more localized or focal context for these differences in cognitive function, it is expected that there would exist more variability at the individual level that is not easily detected at the group level. The current dissertation attempted to approach this limitation in the research by utilizing a battery of measures specific to a cognitive domain. Additionally, given the impact of aging on cognition, the proposed dissertation sought to explore the relationship between self-construal and cognition in the context of the aging brain.

Aging and the Brain

Aging is associated with many notable physiological changes in the brain. Developmentally, the brain appears to mature in the direction from posterior to anterior structures assuring that basic and vital processes, believed to be mediated by some of these more primitive posterior areas, are supported before higher-order processes, which seem to be dependent on more anterior brain regions, are developed. Inversely, healthy aging has been observed to decline in the opposite direction in a “last in, first out” manner where anterior brain regions are affected before posterior regions (Raz, 2000). Recent research has helped elucidate the impact of healthy aging on the brain, which generally appears to be associated with volumetric atrophy and subsequent ventricular expansion. However, these structural changes demonstrate a highly heterogeneous pattern (Fjell & Walhovd, 2010; Raz, Ghisletta, Rodrigue, Kennedy, & Lindenberger, 2010) in which the largest changes take place in frontal and temporal cortices in addition to certain structures, such as the putamen, thalamus, and accumbens (Fjell & Walhovd, 2010).

The volumetric reduction noted in the aging brain may not be related as much to neuronal *loss*, but instead to the shrinkage of neurons, reduction of synaptic spines, and loss of synapses (Fjell & Walhovd, 2010). Similar shrinkage has been noted in the hippocampus, cerebellum, subcortical prefrontal white matter, and caudate while stability of the primary visual cortex and pons is maintained (Raz et al., 2010). Volume loss is evidenced to be nonlinear and, therefore, accelerated in the hippocampus (Raz et al., 2010) and white matter (Salat et al., 2009), areas related to memory and speed of processing, respectively. This white matter deterioration is believed to be a consequence, at least in part, of myelin degeneration (Davis et al., 2009), which can account for the reduction of myelinated axon lengths upwards to 50% (Fjell & Walhovd, 2010).

While deterioration of both gray matter and white matter are observed in healthy aging (Ziegler et al., 2010), the most profound age-associated differences are associated with alterations in white matter, particularly in the frontal lobe, including the medial orbitofrontal region, suggesting a preferential vulnerability in the superior frontal gyrus to the effects of aging (Salat et al., 2009) and lending support to the "last in, first out" hypothesis (Davis et al., 2009). Currently, researchers have brought more attention to these age-related alterations in white matter, which reportedly accelerate with age (Salat et al., 2009). Whereas cortical thinning primarily occurs in primary sensory and motor cortices, white matter changes seem to be localized more to regions underlying association cortices. Some researchers now argue that cognition is associated more with these white matter changes than with cortical thickness (Ziegler et al., 2010). Imaging studies employing fractional anisotropy (Davis et al., 2009) and diffusion tensor imaging (Ziegler et al., 2010) have demonstrated that anterior tracts are primarily associated with executive function tasks whilst visual memory tasks are mediated by white matter changes in posterior tracts. These findings lend to the impression that age-related cognitive changes may arise from degenerative processes in the underlying connection of respective neural network (Ziegler et al., 2010).

Functionally, psychophysiological studies have similarly shown a frontal phenomenon in which older adults show more frontal event-related potential (ERP) activity than young adults and a persistence of a novelty response in a task-relevant event (Peltz, Gratton, & Fabiani, 2011). This research into the P300 wave response suggests age-related increased presence of compensatory processes during cognitive flexibility and attention control tasks. Likewise, it implies age-related difficulty with frontally-mediated inhibitory processes. Other imaging studies using resting state and task-related functional connectivity MRI have demonstrated age-related differences in frontoparietal networks crucial for attention and executive functions (McGinnis, Brickhouse, Pascual, & Dickerson, 2011). For instance, in an updating working memory task in which participants are asked to encode, maintain, and update sequences of digits and asterisks, one study (Podell et al., 2012) found an association between normal aging and poorer task performance. The same study revealed a correlation between task performance and activation in striatal and prefrontal cortical regions in which a reduced ability to efficiently activate crucial neurocognitive systems is evident with advanced aging while activation in less crucial networks is increased. In a related study utilizing a working memory capacity paradigm, older subjects (>55 years of age) demonstrated a threshold effect not present in younger subjects (<35 years of age); in these older subjects physiological compensation through prefrontal cortical activation could not be made in tasks involving higher working memory loads (Mattay et al., 2006). Similar age differences in the activation of prefrontal sites have been shown using positron emission tomography (PET) during both verbal and spatial short-term storage tasks (Reuter-Lorenz et al., 2000). Age-related deficits in social cognition, a higher order executive function, have been noted as localizable to changes in blood-oxygen-level-dependent (BOLD) response on fMRI of the dorsomedial prefrontal cortex (Moran, Jolly, & Mitchell, 2012). Such findings imply a shift from lateralized brain activity in young adults to a Hemispheric Asymmetry Reduction in Old Adults (HAROLD) model during cognitive tasks. Accordingly, older adults employ bihemispheric compensatory strategies to lessen the impact of age-related neurocognitive decline and increased difficulty in recruiting specialized neural mechanisms (Cabeza, 2001).

Although some of these age-related changes may be inevitable, evidence of both neuronal and cognitive plasticity exists and may potentially stimulate each other in the aging brain (Greenwood & Parasuraman, 2010). These adaptive changes of neurons and patterns of cognition may help explain the individual variability in patterns of brain aging. Nonetheless, cognitive decline exists in the non-demented brain and these are significantly mediated by neuroanatomical changes (Cardenas et al., 2011; Fjell & Walhovd, 2010). For instance, an association between longitudinal change in brain structure and longitudinal changes in cognition has been reported in individuals followed over the course of four years (Kramer et al., 2007).

One of the most noted cognitive changes in healthy aging is a decline in memory. This decline has been seen in various types of memory including episodic (Head, Rodrigue, Kennedy, & Raz, 2008), semantic (Cardenas et al., 2011), spatial (Holden & Gilbert, 2012), source memory (Dulas & Duarte, 2014), prospective memory (Mattli, Schnitzspahn, Studerus-Germann, Brehmer, & Zöllig, 2014), and temporal order memory (Tolentino, Pirogovsky, Luu, Toner, & Gilbert, 2012) and has been described as being mediated by shrinkage in hippocampal (Head et al., 2008; Kramer et al., 2007) and entorhinal cortex volumes (Cardenas et al., 2011). Smaller left entorhinal volume has been associated with greater longitudinal decline in verbal memory, smaller left temporal volume has been associated with greater decline in semantic memory, and greater executive decline occurs with smaller frontal lobe volume (Cardenas et al., 2011; Head et al., 2008; Kramer et al., 2007). However, considering the preponderance of changes in white matter associated with normal aging, cognitive processes moderated by these alterations increasingly have become the focus of research on cognition and the aging brain. Executive function abilities have been explained as the primary cognitive domain affected by white matter alterations (Murray et al., 2010).

Executive functions (EFs) are a multi-faceted construct and have been broadly defined in the scientific literature, but they are generally understood as complex higher mental processes used in the formulation of goals, planning, and effective execution of plans (Lezak, 1982). EFs are largely dependent on the integrity of the frontal lobes, which have greater interconnectivity with subcortical brain regions than any of the other lobes (Coolidge & Wynn, 2001). One executive function involves the production of intended actions while self-regulating through the inhibition of unrelated or irrelevant actions (Lezak, Howieson, Loring, Hannay, & Fischer, 2004), herein referred to as *cognitive fluency*. Neuropsychologically, cognitive fluency is often evaluated via verbal and non-verbal measures where the individual is asked to generate a series of novel responses within a category or a set of rules. The tasks are usually timed and failure to inhibit irrelevant responses (e.g., perseverations, intrusions) is often quantified.

Cognitive fluency tasks are popular measures in neuropsychology given their ease and relative short time to administer, yet are sensitive to cognitive impairment due to various etiologies (e.g., both cortical and subcortical dementias, closed head injury, schizophrenia, movement disorders; Kempler, Teng, Dick, Taussig, & Davis, 1998). They have been shown to be particularly sensitive to frontal lobe lesions (Baldo, Shimamura, Delis, Kramer, & Kaplan, 2001) and have even demonstrated utility in predicting global cognitive decline (L. R. Clark et al., 2012). This sensitivity may, in part, be due to the various components of fluency measures, such as clustering and switching (Troyer, Moscovitch, & Winocur, 1997), semantic and inhibitory processes (McDowd et al., 2011), as well as speed of response and mental organization (Kempler et al., 1998). Such a diverse cognitive makeup of fluency measures is reflected in the underlying neural pathways seemingly associated with performance on these measures. For instance, imaging research on verbal fluency generally illustrates a model of particular involvement by three main cortical regions: dorsolateral frontal cortex, temporal cortex, and striate/extrastriate cortex (Friedman et al., 1998). Given the effects of aging on these areas, it is not surprising that performance on fluency measures is generally worse in older adults than in young adults (Elgamal, Roy, & Sharratt, 2011).

Developmentally, it is not clearly understood when in the lifespan particular cross-cultural cognitive differences begin to emerge (Kitayama & Uskul, 2011). Although age-related changes in cognition have been extensively documented, the impact of age only recently has been studied in the context of self-construal and cognition. In what appears to be the first study of its kind on the age-related negativity reduction effect in memory and visual attention, Fung and colleagues (Fung, Isaacowitz, Lu, & Li, 2010) found an interaction of age and self-construal in how negative visual stimuli are processed relative to neutral or positive images. Compared to older individuals with low interdependence, older individuals with increased interdependence demonstrated an attenuation of the negativity reduction effect and were able to attend equally to and recall images regardless of negative or neutral valence. The current study attempted to expand on the dearth of research by examining this interaction in other cognitive processes.

Specific Aims

The objectives of this dissertation can be explained along the lines of three specific aims of this research.

Aim 1. Given the limitations of current methods for measuring self-construals and a need to use multiple measures, the current study intended to employ a novel statistical approach for the assessment of IC. Latent Profile Analysis (LPA) is a multivariate technique used to analyze patterns of responses to continuous variables in order to create "profiles" of individuals in a sample. A review of the extant literature on measures of IC demonstrates that such an approach has not been taken previously. However, the utility of LPA is well-documented. <u>The current dissertation sought to demonstrate the usefulness of LPA in the classification of IC when using multiple measures of self-construal.</u>

Aim 2. The fundamental process of self-construal has been implicated in cultural differences observed in the evaluation of cognitive abilities. However, little research actually has been realized that directly examines the relationship between self-construal and cognition. The perception of the self in the context of others is conceptualized in the proposed dissertation as an advanced human ability similar to other executive functions related to the frontal lobe. <u>Therefore, this project aimed to evaluate the impact of self-construal on executive function in young adults.</u>

Aim 3. Aging is a ubiquitously and naturally occurring progression with an observable effect on cognition and other processes. The role of aging in self-construal only recently has received attention in the literature and the relationship between age, self-construal, and cognition has not been thoroughly characterized. The current study intended to elucidate the effect of aging on the relationship between self-construal and executive function by examining cognitive fluency in older adult individualists and collectivists.

METHOD

Participants

Participants were recruited from two sources. The young adult (YA) group was recruited from a pool of undergraduate psychology students enrolled in an Introduction to Psychology course at San Diego State University (SDSU). YA participants between ages 18 and 26 were recruited to participate. In return, participants received course credit.

The older adult (OA) group was recruited from the general community in the San Diego area through the use of fliers and contacts with community programs serving older adults. For participation, OA participants needed to be at least 60 of age. OA participants received $10 for their participation.

Inclusion/Exclusion Criteria. While participants had to be within the aforementioned age ranges in order to participate, there were no gender, race, or ethnicity restrictions on enrollment. Participants were asked about their English proficiency and number of years living in the United States. Participants who did not feel comfortable reading, writing, and speaking in English in order to complete study measures were excluded from the study. Participants had to be able to provide written informed consent and not have a diagnosis of dementia (e.g., Alzheimer's disease) or a cognitive disorder (e.g., MCI) at the time of testing. Although participants were not excluded from participation based on history of psychiatric diagnoses or substance use, information regarding these was collected in order to control for their potential effect on performance in data analysis.

Power Analysis. A total of 201 participants (101 YA and 100 OA) were recruited. An *a priori* power analysis performed using G*Power, Version 3.1 (Faul, 2008), demonstrated that this sample size would be sufficient to detect a medium effect size (f=0.25) statistically significant at the $p<0.05$ level.

Protection of Research Participants. All participants signed informed written consent approved by the Institutional Review Boards (IRB) at both San Diego State University (SDSU) and the University of California, San Diego (UCSD). The current study functioned as part of a larger study protocol titled “Cognitive, motor, and behavioral changes associated with aging and neurodegenerative disease” (SDSU IRB Study Number: 606069). The current study had no foreseeable associated risks or discomforts besides the boredom and fatigue that may be experienced during periods of cognitive testing. Also, participants were informed during the consenting process that the study had no foreseeable direct benefits to them. All study materials and data were kept confidential and participants’ names and other identifying information (e.g., date of birth) were removed from the data to be analyzed. Data were kept in a locked cabinet and digital data were password-protected. Only study personnel had access to research records.

Design

A cross-sectional, 2 (age group) x 2 (self-construal) factorial design was used. Individuals who agreed to participate were asked to fill out three instruments used in the measurement of IC (described below). After completing these instruments, a member of the research team individually interviewed each participant in order to collect pertinent demographic as well as health and medical history information. The research team member administered a brief battery (approximately 30 minutes in length), assessing for cognitive fluency. Lastly, participants were asked to complete two self-report measures that assessed for mood before being debriefed. Participants generally were able to finish all measures within an hour.

Measures

The instruments used in this study can be categorized into demographic, self-construal, cognitive, and mood measures.

Demographic. All participants were given a brief semi-structured interview by a member of the research team in order to collect information related to the participant's demographic background. This included information such as birthplace, race and ethnicity, first language spoken, fluency in the English language, and years living in the United States. Additionally, pertinent medical history, such as history of head injury, learning disability, stroke, and substance use were collected.

Some additional demographic measures were administered to the OA group in order to gather other information on language and acculturation:

Bilingual Dominance Scale (*BDS*; Dunn & Fox Tree, 2009). This brief scale is administered as an interview and assesses an individual's bilingualism. Consisting of 12 items, the measure evaluates the person's predominant use of one language over another or the equal use of the two languages by targeting three main criteria: percent of language use, age of acquisition, and restructuring of language fluency.

Stephenson Multiphasic Acculturation Scale (SMAS; Stephenson, 2000). This reliable and validated self-report measure of acculturation consists of 32 statement rated on a four-point scale (i.e., false, partly false, partly true, true). Items relate to domains of language, interaction, media, and food in the context of either the society of origin or the current society of residency. The measure allows for the calculation of two indices: the dominant society immersion (DSI) and the ethnic society immersion (ESI).

Self-construal. Given that culture is defined by explicit beliefs and values, researchers have employed self-report survey questions on cultural attitudes as primary research tools. Thus, there are many methods of measuring IC with numerous studies demonstrating highly variable reliability and validity (Oyserman, 2002). In a review of various survey methods, Peng, Nisbett, and Wong (1997) found significant limitations of rating and ranking measures in the assessment of IC when used to differentiate between cultures. Due to the unsatisfactory limitations of these methods, it is necessary to use more than one method (H. Triandis, personal communication, November 5, 2010). Therefore, this study used a mixed methods approach to examine how IC is related to cognitive fluency.

After participants completed the demographic interview, three self-report measures of self-construal were given to each participant to complete.

INDCOL (Triandis, 1996). The 32 items of this self-report questionnaire provide two main scores and four sub-scores; the two main scores were used for classification of IC. Respondents are asked to rate their agreement with a statement (e.g., “I usually sacrifice my self-interest for the benefit of my group) on a 9-point scale ranging from Strongly Disagree (1) to Strongly Agree (9). Of these 32 items, 16 relate to individualism and 16 relate to collectivism. The average of each set of items comprises the score for the subscale.

Scenarios (Triandis, 1998). This 16-item measure employs hypothetical scenarios (e.g., "You and your friends decided spontaneously to go out to dinner at a restaurant. What do you think is the best way to handle the bill?") in order to calculate two scores: overall individualism and overall collectivism. After reading each scenario, individuals are asked to check one of four choices, each of which relates to a particular IC construct. A concern of assessing IC with self-report measures is that of possible group reference effects, in which an individual perceives an item or situation as it is related to a salient social group better than as the item or situation is processed in some other manner (Johnson et al., 2002). This type of measure assessing for IC that employs scenarios has been shown to maintain reasonable criterion validity while being less affected by group reference effects (Peng et al., 1997).

Twenty Statements Test (TST; Kuhn & McPartland, 1954). This qualitative measure of cross-cultural self-concept has been used extensively as a way of respondents to openly describe themselves (e.g., Bond & Cheung, 1983; Rhee, Uleman, Lee, & Roman, 1995; Santamaria, de la Mata, Hansen, & Ruiz, 2010; Trafimow, Triandis, & Goto, 1991; Wang, 2001). As past research suggests, an abbreviated version of the TST was used due to the increased probability of repeated responses after the first ten statements (Grace, 2002; Watkins, 1997). Respondents were given a sheet with ten numbered blanks prefaced with the words "I am…" and were asked to simply fill the blanks answering the question "Who am I?" for each blank. These responses were then coded by two raters who are blinded to the participant's responses to other test materials, including other IC measures. TST responses were coded along two domains: organization and evaluation (Santamaria et al., 2010; Wang, 2001). The organization of a statement was coded as either *private* (e.g., “I am smart”), *collective* (e.g., “I am a student”), or *public* (e.g., “I am someone who cares for others”). Statements are similarly coded for evaluation as *positive* (e.g., “I am a good friend”), *negative* (e.g., “I am ugly”), or *neutral* (e.g., I am a person). Scores along the organization domain were used for evaluation of IC.

Cognitive. Upon completing the self-construal measures, a research team member administered a brief cognitive battery. This battery largely assessed for cognitive fluency as well as working memory.

Action Fluency Test (*AFT;* Piatt, Fields, Paolo, & Tröster, 1999). The AFT is a cognitive measure of frontal function. An examiner provides the respondent with a verbal prompt that instructs to list “as many different things as you can think of that people do” and records all responses listed within one minute.

Semantic Fluency (Animals, Fruits, Vegetables). Another commonly used task in neuropsychological assessment is category fluency. These tasks assess for verbal fluency and working memory by prompting respondents to generate the names of as many items in a particular semantic category as they can recall in one minute. For purposes of this study, the categories of “Animals,” “Fruits,” and “Vegetables” were used due to their wide use in memory research. In the OA group, an additional semantic fluency, Verbal Fluency Switching (Fruits – Furniture, *Delis-Kaplan Executive Function Scales, or D-KEFS;* Delis, Kaplan, & Kramer, 2001) was used in place of the “Fruits” category.

Idea Fluency (*The Brick Use Test;* Guilford, Christensen, Merrifield, & Wilson, 1978). A divergent thinking test, the Brick Use Test is part of a collection of tests that prompt respondents to name as many original and alternate uses of an item, a brick in this case (e.g., "weight-training," "paper-weight," "to throw at my sister") in one minute. The Brick Use Test has been used to help measure idea fluency and general creativity (Lezak et al., 2004).

Phonemic Fluency (*Controlled Oral Word Association Test, or COWAT;* Benton & Hamsher, 1978). The COWAT is a popular verbal fluency test sensitive to frontal lobe functions. It asks respondents to name as many words they can recall in one minute that begin with a certain letter. The most commonly used form of the COWAT, and the form used in the current study, prompts respondents to name words that begin with letters F, A, and S with one minute for each letter.

Design Fluency (D-KEFS; Delis, Kaplan, & Kramer, 2001). This nonverbal fluency measure complements the aforementioned verbal fluency measures by asking participants to make a series of unique designs by connecting a group of dots with a line. The switching condition used in the current study requires participants to additionally alternate between two colors of dots (black, white) when connecting them with a line.

Digit Span. This widely-used attention and working memory task asks respondents to remember and repeat a series of increasing number sequences both forward in order and in reverse (e.g., "1-2" is repeated as "2-1") after an examiner reads them aloud (Miller, 1956). One point is given for each correctly repeated sequence.

Judgment of Line Orientation (JOLO; Benton, Varney, & Hamsher, 1978). As a measure of visuospatial abilities, the JOLO asks respondents to observe pairs of line segments that are in different locations and at different angles on a page. They compare these pairs with a standard reference set of numbered lined and state which two reference lines correspond with the pair of line segments. A point is given for each correct pair.

Wide Range Achievement Test: Fourth Edition – Reading subtest (*WRAT-4 Reading*; Wilkinson & Robertson, 2006). This word identification test has been validated and used extensively as a proxy measure of premorbid function (Ahl et al., 2013). During the test, the individual is shown a list of words and asked to pronounce them. The list is ordered by increasing difficulty and the individual is given a point for each correct pronunciation.

Mini-Mental State Exam (*MMSE;* Folstein, Folstein, & McHugh, 1975). The MMSE is a widely used measure shown to be a reliable and valid measure of global cognitive status (Tombaugh & McIntyre, 1992). This paper-and-pencil measure is administered by an interviewer and asks the respondent questions measuring various cognitive domains, including (1) orientation, (2) language, (3) delayed recall, (4) attention, and (5) visual constructional praxis. A total of up to 30 points can be scored and scores below 26 suggest cognitive dysfunction. The MMSE was administered to participants in the older adults group in order to offer a brief screen for possible cognitive impairment associated with aging. Although not without limitations and not intended for diagnostic purposes, the MMSE was shown by a recent meta-analysis to have modest accuracy with best value for ruling out dementia in community and primary care (Mitchell, 2009). Individuals with MMSE scores below 26 were not included in the data analysis.

Mood. The impact of mood on cognition is reasonably described in the research literature (Langenecker, Lee, & Bieliauskas, 2009). Depression has been reported to have a negative impact on performance in measures of executive function (Grant, Thase, & Sweeney, 2001; Langenecker et al., 2005; Paelecke-Habermann, Pohl, & Leplow, 2005). For instance, patients with Major Depressive Disorder have shown relative deficits in some verbal fluency tasks (Porter, Gallagher, Thompson, & Young, 2003) and sustained attention (Rose & Ebmeier, 2006) as compared to healthy controls. Therefore, mood symptoms were assessed for each participant.

Beck Depression Inventory, Version 2 (*BDI-II;* Beck, Steer, Ball, & Ranieri, 1996). In order to control for any cognitive deficits due to depressive symptoms, the BDI-II was used. This self-report measure asks respondents to answer 21 items based on diagnostic criteria for depression. Each item has options scaled from zero to three. Higher scores on each item relate to increased severity of depressive symptoms. Only YA participants were given the BDI to complete.

Geriatric Depression Scale (GDS; Yesavage et al., 1982). The GDS, a 30-item self-rating screening tool for depressive symptoms, was developed for use in older adults by distinguishing symptoms of depression and dementia. It contains items that represent characteristic affective and cognitive symptoms of depression in older adults while eliminating items related to somatic concerns common in this population (Smarr & Keefer, 2011). A 15-item short version was designed to decrease fatigue while remaining sensitive to depression among elderly persons (Sheikh & Yesavage, 1986). The GDS short version was administered only to OA participants, in which the BDI-II may be less appropriate.

Profile of Mood States- Standard Version (POMS; McNair, Lorr, & Droppleman, 1971). This 65-item self-report measure provides a rapid method of assessing transient, fluctuating active mood states that may interfere with participants' cognitive abilities. Participants are given 65 adjectives (e.g., Friendly, Confused, Grouchy) and are asked to rate how much they feel like each adjective on a 5-point scale. The POMS provides information on six scales: Tension-Anxiety, Anger-Hostility, Fatigue-Inertia, Depression-Dejection, Vigor-Activity, and Confusion-Bewilderment. A Total Mood Disturbance (TMD) is calculated by subtracting the raw Vigor-Activity score from the sum of raw scores for the remaining five scales.

Analysis

Statistical analysis was a two-part process. The first part sought to determine IC classification for each participant. That is, this step categorized each participant as either individualistic or collectivistic. The results of the first step were then used in the second step of the analytical process. In this second tier of analyses, categorical variables from the first step were utilized as the independent variable when comparing cognitive performance in relation to IC for each age group.

Preliminary Analyses. Latent Profile Analysis (LPA), which allows researchers to identify typologies of people as opposed to a taxonomy of variables, is a person-centered technique in which an individual can be assigned to a mutually exclusive profile based on that individual's responses to observed continuous variables of interest (Roesch, Villodas, & Villodas, 2010). The process of LPA seeks to maximize homogeneity within groups and maximize heterogeneity between groups (Lanza, Flaherty, & Collins, 2003). Various models are tested to determine the optimal number of profiles and the best-fitting model is chosen based on various statistical indices of fit.

Participants' responses on the three IC measures provided multiple scores. The INDCOL provided two scores, one for overall individualism and one for overall collectivism. The Scenarios measures provided two raw scores, similarly one for overall individualism and one for overall collectivism. Lastly, each rater coding responses on the TST provided a total number of private, collective, and public statements, resulting in two sets of three scores that were then averaged between the raters to create three mean scores. Therefore, each participant had a total of seven scores entered into the LPA. Given that the relationship between age and self-construal is not fully understood, LPA was performed separately for each group (YA, OA). A 2-, 3-, and 4-profile solution were tested using Mplus, version 6.12 (Muthén & Muthén, 2010).

Main Analyses. Due to the 2 (IC group) x 2 (age group) study design and the existence of covariates (e.g., mood, education), analysis of covariance (ANCOVA) was used to examine the relationship of self-construal on cognition for each age group. In order to evaluate cognitive measures independently of each other, a separate ANCOVA was performed for each cognitive test. Findings with *p*-values at or less than .05 were considered significant. All analyses were conducted using PASW, version 18 (SPSS, Inc., 2009).

HYPOTHESES

Aim 1: To demonstrate the usefulness of LPA in the classification of IC when using multiple measures of self-construal

Hypothesis 1. Consistent with the binary classification of self-construal distinguishing between individualism and collectivism, it was hypothesized that LPA would demonstrate a 2-factor solution as a better fit to the data than the 3-factor or 4-factor solution in both young adults (YA) and older adults (OA). This would allow for the successful IC classification of participants within each group based on their combined responses to all IC measures.

Aim 2: To evaluate the impact of self-construal on executive function in young adults (YA)

Hypothesis 2. As a result of the collectivist individual's concern with others and the subsequent pull on cognitive resources, it was hypothesized that collectivism would be negatively associated with performance on cognitive fluency in YA. In other words, the collectivist group would have lower scores on cognitive measures than the individualist group.

Aim 3: To elucidate the effect of aging on the relationship between self-construal and executive function

Hypothesis 3. It was predicted that the relationship of Self-Construal and Cognitive Fluency would differ by age, such revealing that the young adult (YA) group would perform generally better than the older adults (OA) group on cognitive measures. It was expected that collectivists develop compensatory strategies throughout adulthood. Therefore, it was hypothesized that the negative association between collectivism and cognition (Hypothesis 2) seen in the YA group would be attenuated in the OA group.

RESULTS

Sample Characteristics. A total of 101 YA (Mean age: 19.2±1.6) and 100 OA (Mean age: 67.2±6.0) were recruited. The groups had similar levels of education (YA Mean years of education: 14.1±1.5, OA Mean: 14.5±2.8, $p>.05$). Both age groups consisted mostly of individuals who self-identified as white, non-Hispanic, and female (Table 1). Although the percentage of participants that were female did not differ by age group (X^2[1, N=187]=2.72, $p>.05$), YA and OA differed significantly on distribution of ethnicity (X^2[1, N=182]=12.22, $p<.001$) and race (X^2[1, N=187]=31.22, $p<.001$).

Data were checked for normality and outliers. Of the OA group, 6 individuals withdrew consent or were unable to complete all measures, 7 were excluded from analyses due to MMSE scores less than 26, and 1 was excluded due to outlying values (>2 standard deviations) on several measures in addition to a history of head injury and cognitive symptoms. Therefore, 101 YA and 86 OA were included in final analyses.

Table 1. Sample Demographics

	YA n=101				OA n=86			
	Min	***Max***	***Mean***	***SD***	***Min***	***Max***	***Mean***	***SD***
Age (years)	18	26	19.2	1.6	60	88	67.2	6.0
Education (years)	12	19	14.1	1.5	8	20	14.5	2.8
Years in US	0	26	17.2	4.7	4	80	61.5	14.5

Gender	***n***	**%**	***n***	**%**
Male	35	34.7	40	46.5
Female	66	64.3	46	53.5
Ethnicity				
Hispanic	27	26.7	6	7.0
Non-Hispanic	72	71.3	77	89.5
Race				
American Indian	2	2.0	1	1.2
Asian	17	16.8	5	5.8
Black	1	1.0	11	12.8
Multiple	8	7.9	4	4.7
Pacific Islander	4	4	1	1.2
Unknown	20	19.8	3	3.5
White	49	48.5	61	70.9

SELF-CONSTRUAL MEASURES

Descriptives. As shown in Table 2, both groups responded similarly on the self-construal measures overall with the exception of two sub-scales. Additionally, self-construal scores were not significantly correlated with race or ethnicity in either group (all *p*s>.05).

Table 2. Mean (SD) Scores on Self-Construal Measures by Group

	YA n=101		OA n=86			
Measure	***M(SD)***	**95% CI**	***M(SD)***	**95% CI**	***t*(185)**	***p***
INDCOL Ind	6.35(.86)	[6.18, 6.52]	5.77(1.09)	[5.53, 6.00]	3.96	<.01
INDCOL Col	6.84(.65)	[6.71, 6.96]	6.76(1.29)	[6.48, 7.04]	.489	.61
Scenarios Ind	8.63(1.97)	[8.24, 9.02]	8.33(2.40)	[7.81, 8..84]	.961	.34
Scenarios Col	7.33(1.96)	[6.94, 7.71]	7.49(2.49)	[6.96, 8.02]	-.488	.62
TST Private	3.21(1.89)	[2.83, 3.58]	3.31(2.18)	[2.84, 3.78]	-.348	.73
TST Col	3.41(2.24)	[2.96, 3.85]	2.44(2.00)	[2.01, 2.87]	3.069	<.01
TST Public	1.06(1.01)	[.86, 1.26]	0.91(1.02)	[.69, 1.13]	1.031	.30

Note. Ind = Individualism score; Col = Collectivism score; CI=Confidence Interval

Inter-rater Reliability. As noted previously, two raters independently scored participants' responses to the TST. Raters were blind to participants' responses to the other measures of self-construal. Inter-rater reliability was assessed using the intra-class correlation coefficient (ICC) and was found to be high for both the YA (Cronbach's alpha = .94, ICC = .89) and the OA (Cronbach's alpha = .97, ICC = .94).

Latent Profile Analysis. Latent profile analyses (LPA) testing two, three, and four classes of profiles were fit to the data by group. The model fit indices for each LPA are available in Table 3. Fit indices did not indicate a statistically significant improvement of the 3-class solution from the 2-class solution (YA: p = .22; OA: p = .16). Despite greater entropy and the presence of a statistically significant improvement of the 4-class solution over the 3-class solution, *s*ubstantive interpretation of conditional response means in the 4-class (Table 4) suggests that some profiles of scores do not maximally describe a well-defined pattern of responses on the IC measures. For instance, response means in class 1 depict a profile with limited interpretability given variable values on individualist and collectivist subscales. Therefore, the more parsimonious solution, the 2-Class solution (Table 5), was considered a better fit to the data (see Lubke

& Muthén, 2005). For the YA group, latent class probabilities for each class were 55.4% (*n*=56) in class 1 and 44.6% (*n*=45) in class 2; in the OA group, latent class probabilities for each class were 48.8% (*n*=42) in class 1 and 51.2% (*n*=44) in class 2. Considering the conditional response means (see Table 5), class 1 was defined primarily as a high individualism class, or "individualists"; class 2 was defined primarily as a high collectivism class, or "collectivists."

Table 3. Overall Model Fit for Class Solutions

		Class Solution		
		2	3	4
	AIC	2384.65	2329.08	2257.65
	BIC	2442.19	2407.53	2357.03
YA	**sBIC**	2372.70	2312.78	2237.00
	Entropy	.870	.890	.983
	LMRT (*p*)	<0.01	0.22	0.01
	AIC	2265.37	2225.07	2189.46
	BIC	2319.36	2298.70	2282.72
OA	**sBIC**	2249.95	2204.05	2162.83
	Entropy	.793	.859	.940
	LMRT (*p*)	.07	.16	.27

Note: AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; sBIC=Sample-size adjusted Bayesian Information Criterion; LMRT=Lo-Mendell-Rubin Test-adjusted likelihood ratio (*p*-value).
Better fit of the model is indicated by lower AIC, BIC, and sBIC. Higher entropy scores suggest improved differentiation of profiles (1.0 = perfect classification).

Table 4. Table of Means: Four-Class Solution

Group	Variable	Overall Item Means	Four-Class Solution			
			Class 1	Class 2	Class 3	Class 4
YA	INDCOL Ind	6.35	6.41	6.31	6.01	6.52
	INDCOL Col	6.84	6.94	6.88	7.05	6.41
	Scenarios Ind	8.63	9.41	7.41	5.38	11.42
	Scenarios Col	7.33	6.54	8.53	10.61	4.59
	TST Private	3.21	3.38	3.22	3.14	2.90
	TST Collectivist	3.41	3.11	3.88	3.00	3.45
	TST Public	1.06	1.41	0.71	1.39	0.76
	N	101	37	32	13	19
OA	INDCOL Ind	5.76	6.20	5.70	5.94	5.01
	INDCOL Col	6.76	5.63	7.05	6.41	8.05
	Scenarios Ind	8.33	12.13	7.10	9.68	4.24
	Scenarios Col	7.49	3.30	8.75	6.23	11.57
	TST Private	3.31	3.62	3.22	3.66	2.22
	TST Collectivist	2.44	2.45	2.66	2.02	3.03
	TST Public	0.91	0.56	0.83	1.03	1.15
	N	86	10	34	32	10

Note: Ind=Individualism score; Col=Collectivism score; TST=Twenty Statements Test

Table 5. Table of Means: Two-Class Solution

Group	Variable	Overall Item Means	Two-Class Solution	
			Class 1	Class 2
YA	INDCOL Ind	6.35	6.46	6.21
	INDCOL Col	6.84	6.76	6.93
	Scenarios Ind	8.63	10.08	6.89
	Scenarios Col	7.33	5.89	9.09
	TST Private	3.21	3.24	3.17
	TST Collectivist	3.41	3.22	3.63
	TST Public	1.06	1.17	0.92
	N	101	56	45
OA	INDCOL Ind	5.76	5.99	5.56
	INDCOL Col	6.76	6.19	7.32
	Scenarios Ind	8.33	10.23	6.48
	Scenarios Col	7.49	5.55	9.37
	TST Private	3.31	3.69	2.94
	TST Collectivist	2.44	2.10	2.78
	TST Public	0.91	0.86	0.95
	N	86	42	44

***Note**:* Ind=Individualism score; Col=Collectivism score; TST=Twenty Statements Test

COGNITIVE MEASURES

Descriptives. Table 6 demonstrates overall performance on cognitive measures by both the YA and OA groups. As expected, the YA generally performed better than the OA group on several of the cognitive measures. Performances on cognitive measures by individualists and collectivists for each age group are also provided (Table 7).

Table 6. Mean (SD) Performance on Cognitive Measures by Age Group

Measure	**YA N=101**	**OA N=86**	***t(186)***	***p****	**β**	**95% CI**
AFT	16.9(4.6)	16.5(5.1)	.61	NS	.429	[-.97, 1.83]
FAS	38.1(9.1)	35.4(12.0)	1.69	NS	2.61	[-.44, 5.65]
Animals	19.7(3.9)	18.5(4.4)	2.09	.038	1.26	[.07, 2.44]
Fruits	14.3(4.0)	NA				
Vegetables	10.1(3.1)	11.9(4.4)	-3.47	.001	-1.75	[-2.75, -.76]
VF Switching	NA	11.5(3.0)				
Brick	7.5(3.3)	4.5(3.0)	6.56	<.001	3.01	[2.11, 3.92]
Digit Span Forward	NA	9.8(1.9)				
Digit Span Backward	7.4(2.1)	6.7(2.0)	2.16	.032	.663	[.06, 1.27]
Design Fluency Switching	9.0(3.3)	6.1(2.2)	6.86	<.001	2.90	[2.07, 3.74]
Design Fluency Non-Switching	NA	8.8(3.1)				
JOLO	NA	22.6(5.3)				

Note: Reported *p*-values compare YA with OA groups on each measure; AFT = Action Fluency Test; FAS=Phonemic Fluency with F, A, and S; VF Switching=Verbal Fluency Switching Condition Total Correct; Brick=Brick Use Test; JOLO=Judgment of Line Orientation Test; NA=Not Administered; NS=Non-Significant, CI=Confidence Interval

Table 7. Mean (SD) Performance on Cognitive Measures by Self-Construal

	YA		OA	
Measure	**Ind N=56**	**Col N=45**	**Ind N=42**	**Col N=44**
AFT	17.6(4.9)	16.1(4.0)	15.9(5.2)	17.1(4.9)
FAS	39.3(9.6)	36.5(8.1)	34.3(13.2)	36.5(13.2)
Animals	20.2(4.1)	19.2(3.6)	18.3(4.0)	18.6(4.7)
Fruits	14.9(4.4)	13.5(3.3)	NA	NA
Vegetables	10.4(3.5)	9.8(2.4)	12.0(4.1)	11.8(3.7)
VF Switching	NA	NA	11.2(3.1)	11.8(2.9)
Brick	7.8(3.5)	7.1(3.0)	4.4(3.0)	4.5(2.9)
Digit Span Forward	NA	NA	9.9(2.1)	9.6(1.8)
Digit Span Backward	7.3(2.1)	7.5(2.3)	7.0(2.0)	6.5(2.0)
Design Fluency Switching	9.3(3.8)	8.8(2.8)	6.2(2.2)	6.0(2.3)
Design Fluency Non-Switching	NA	NA	9.2(3.1)	8.5(3.1)
JOLO	NA	NA	22.7(5.0)	22.5(5.6)

Note*:* AFT = Action Fluency Test; FAS=Phonemic Fluency with F, A, and S; VF Switching=Verbal Fluency Switching Condition Total Correct; Brick=Brick Use Test; JOLO=Judgment of Line Orientation Test; Ind=Individualist group; Col=Collectivist group; NA=Not Administered

ANCOVA. A one-way analysis of covariance (ANCOVA) was used to evaluate differences between individualists and collectivists on cognitive measures while controlling for the possible effects of covariates. YA and OA were analyzed separately. Covariates were chosen for theoretical and statistical reasons. Age, ethnicity, race, years of education, years in the United States, mood, acculturation, English fluency, and relevant medical history (e.g., heavy substance use, brain injury) were considered. In the YA group, only age, ethnicity, and years in the United States were significantly correlated (p<.05) with the outcome variables and, therefore, included in the ANCOVA. Similarly, ethnicity, race, and WRAT-4 Reading scores were significantly correlated with cognitive performance in the OA group and included in the analyses as covariates. WRAT-4 Reading was used as a proxy for level of education given its stronger statistical relationship to the outcome variables than years of education. This is consistent with other research demonstrating how such literacy measures may be useful in accounting for level of education, especially in ethnically diverse samples with heterogeneous educational backgrounds (Manly, Schupf, Tang, & Stern, 2005) and in the elderly (Bolla, Gray, Resnick, Galante, & Kawas, 1998).

Self-construal was not significantly related to cognitive performance in the YA, where individualists and collectivists performed similarly on all cognitive measures (all *p*s>.05). However, in the OA group, collectivists outperformed individualists on several verbal measure of cognitive fluency, specifically the Action Fluency Test (AFT), phonemic fluency (FAS), and Verbal Fluency Switching, with medium effect sizes (Table 8). Both groups performed similarly on all other measures.

Table 8. Estimated Means (SE) on Cognitive Measures by Self-Construal Controlling for Ethnicity, Race, and WRAT-Reading in OA

Measure	**Ind N=42**			**Col N=44**				
	Mean	***SE***	***95% CI***	***Mean***	***SE***	***95% CI***	***p***	***d***
AFT	21.94	.83	20.3-23.6	23.12	.80	21.5-24.7	.037	.490
FAS	32.03	1.72	28.6-35.4	37.78	1.66	34.5-41.1	.021	.545
Animals	18.01	.71	16.6-19.4	18.94	.68	17.6-20.3	.365	
Vegetables	11.54	.60	10.4-12.7	12.15	.58	11.0-13.3	.482	
VF Switching	10.83	.46	9.9-11.74	12.13	.44	11.2-13.0	.050	.461
Brick	4.10	.43	3.2-5.0	4.79	.41	4.0-5.6	.266	
Digit Span Forward	9.63	.29	9.1-10.2	9.81	.28	9.3-10.4	.669	
Digit Span Backward	6.62	.30	6.0-7.2	6.68	.29	6.1-7.3	.906	
Design Fluency Switching	6.03	.25	5.3-6.7	6.19	.33	5.5-6.9	.748	
Design Fluency Non-Switching	8.59	.45	7.7-9.5	9.00	.43	8.1-9.9	.513	
JOLO	21.94	.83	20.3-23.6	23.12	.80	21.5-24.7	.323	

Note: SE=Standard Error; CI=Confidence Interval; AFT = Action Fluency Test; FAS=Phonemic Fluency with F, A, and S; VF Switching=Verbal Fluency Switching Condition Total Correct; Brick=Brick Use Test; JOLO=Judgment of Line Orientation Test; Ind=Individualist group; Col=Collectivist group.
Cohen’s d estimate (d) is provided for significant variables only.

DISCUSSION

SPECIFIC FINDINGS

Aim 1. As part of Aim 1, which sought to demonstrate the usefulness of LPA in the classification of IC when using multiple measures of self-construal, it was hypothesized that a 2-factor solution would be a better fit to the data than the 3-factor or 4-factor solution in both young adults (YA) and older adults (OA). Indeed, consistent with these expectations, 3- and 4-factor solutions did not fit the data significantly better than a 2-factor solution along the dimensions of individualism and collectivism. Some research suggests an orthogonal relationship between these two dimensions such that an individual can be high or low on both dimensions or high on only one of the dimensions (e.g., Triandis et al., 1986). However, responses on the IC measures from both the YA and OA revealed that individuals were generally high on only one dimension. This might explain why a 4-factor solution was not a better fit to the data.

The LPA results exhibit the utility of using such analyses in the exploration of IC for several reasons. Primarily, analyses of latent variables allow for the optimization of shared variance between related variables. Given the nature of this method, it additionally eliminates error specifically in the latent variable, resulting in a variable that is a direct reflection of the observed variables included in the model.

Second, given the additional benefit of employing multiple measures of IC in the assessment of self-construal, LPA provides an opportunity to include various scores. It then essentially distills these into a classification that is free of error. Additionally, the results of the LPA can be used in further analyses.

Moreover, the crux of research related to self-construal relies on a dichotomous categorical variable – individualism versus collectivism. However, self-construal measures, including those used in this study, typically provide continuous scores along each domain, potentially making a categorical distinction difficult to establish and limiting comparison with other studies. LPA helps examine consistencies between scores within individuals and define profiles of response patterns. These profiles of continuous variables can then be converted into categorical variables that aid in explaining sample characteristics and compare research findings.

A caveat to be considered with the use of such modeling techniques as LPA is that the models analyzed are only as good as the elements included within the model. Therefore, although the latent variable produced by the LPA is statistically free of measurement error, it may not be entirely reflective of the construct of interest since a model is only as good as what is included. This, however, might not be a limitation of the current research. The three measures used for purposes of evaluating self-construal (INDCOL, Scenarios, TST) are self-report measures that have been extensively researched and validated for these purposes (Oyserman, 2002). Given their theoretical and empirical support, it is likely that these measures were effectively appropriate for inclusion in analyses.

However, a limitation of the LPA is that it also relies on the sample data included in the analyses. While recruitment efforts attempted to maximize diversity in terms of race and ethnicity, it is nevertheless possible that greater variability in self-construal could be obtained with a different sample. Therefore, results may have been different with a more diverse sample.

Future studies may wish to explore the efficacy of LPA in self-construal research that includes more diverse populations. For instance, a study that incorporates responses from samples of individuals living in the United States, an individualist culture, and a samples of individuals living in Japan, a collectivist culture, may further extend these findings and clarify the utility of LPA in the evaluation of self-construal.

Aim 2. Aim 2 sought to evaluate the impact of self-construal on executive function in YA and it was expected that collectivism and performance on cognitive fluency would be negatively associated. However, this was not supported by findings in the YA group; there were no significant differences between individuals and collectivists on cognitive measures beyond the effects of common covariates, such as ethnicity and years of education.

As described previously, when cultural differences begin to emerge is not completely known, despite evidence that culturally divergent cognitive performances exist even in very young children (Chen et al., 1998; Lahat et al., 2010; Sabbagh et al., 2006). Moreover, while much of the research on IC assumes self-construal based on the participants' country of origin, self-belief measures do not reliably seem to predict behavioral responses (e.g., cognition, attention); instead, they appear to be more reliable in predicting corresponding neural responses (Kitayama & Uskul, 2011). Given that behavior is a product of both neural processes and environmental factors (Ajzen, 1985), it is possible that cultural differences of self-construal on cognition are too subtle to detect, or are nonexistent, in young adults. Additionally, as described by McDowd and colleagues (McDowd et al., 2011), the limited cognitive battery used may not have been broad or sensitive enough to capture some of these subtle differences in younger adults.

Although it is difficult to assess with a cross-sectional design in which self-construal is assessed at only one time-point, the possibility exists that adult brains ultimately compensate for the differential culture-specific responses seen in children and adolescents. Similar compensation has been observed in adults as compared to adolescents when comparing mPFC activation on fMRI during self-knowledge retrieval and self-reflection (Pfeifer et al., 2009; Pfeifer, Lieberman, & Dapretto, 2007). Future research could attempt to expand on this by comparing a young adult population with a younger, adolescent population or longitudinally by following adolescents into young adulthood.

Aim 3. Elucidation of the effect of aging on the relationship between self-construal and executive function was the focus of Aim 3. It was expected that an effect observed in the YA group would be attenuated in the OA group. Instead, despite there being no relationship between IC and cognition observed in the YA, collectivists outperformed individualists on several cognitive measures in the OA group.

Contrary to the expected direction in which collectivism would be associated with relatively worse performance on cognitive fluency measures, older collectivists performed significantly better on three verbal measures of cognitive fluency after controlling for linguistic ability. Both older groups performed similarly on nonverbal measures of cognitive fluency, tests of working memory and attention, and a test of visual cognition. These findings support previous literature suggesting that self-construal may be differentially associated with verbal and nonverbal measures (Hedden et al., 2002).

As described previously, verbal fluency measures rely on various components linked to various cortical processes. Interestingly, performance on these does not always rely on semantic memory or vocabulary knowledge (e.g., Kempler et al., 1998; McDowd et al., 2011; Nagels et al., 2012). As explained by McDowd and colleagues (McDowd et al., 2011), overall performance on verbal fluency measures is most consistently predicted by speed of processing with an additional, albeit secondary, contribution by inhibitory processes. This might explain why the effect in the current results was found after controlling for linguistic ability using the WRAT-Reading. In addition, it might explain why the effect was not found in an untimed working memory verbal task (Digit Span – Backward) or in non-verbal design fluency, which relies primarily on motor planning and visual scanning rather than processing speed (Suchy, Kraybill, & Gidley Larson, 2010). However, the effect was not found in similarly timed measures (e.g., Animals, Vegetables), suggesting that this effect may be due more to differences in executive function between the two groups. Future studies that include measures of processing speed are needed to further elucidate the role of processing speed and executive function.

These findings suggest a cognitive advantage in executive function of collectivists over individualists. Nonetheless, the reason for this cognitive advantage on these measures is unclear. As in the YA group, the potential exists that this is a manifestation of neural compensation. That is, collectivists, accustomed to regular executive demands, may have developed certain strategies to more efficiently handle the demands of these cognitive tasks. An analogous pattern has been documented in research on perception in which cultural differences in object processing were magnified with age in a sample of younger and elderly Singaporeans and Americans (Chee et al., 2006). Evidence of neuroplasticity in adults and of changes in neural processing related to acculturation (Hedden et al., 2008) would suggest that development of compensatory strategies is possible even in an elderly population. However, such an explanation is dependent on the assumption that these individuals have been individualists or collectivists over a period of time, an assumption that cannot be asserted by the current cross-sectional design.

GENERAL IMPLICATIONS OF FINDINGS

The current findings complement extant literature in various ways. With the exception of two subscales, both age groups were comparable in self-construal. In at least one study, using a single measure of self-construal, older adults were more individualistic than younger adults despite previous research suggesting the contrary (Guo, Schwartz, & McCabe, 2008). Apparent age-related differences in self-construal, though, may be due to cohort effects related to generational shifts rather than social change patterns (Bengtson & Lovejoy, 1973). The results reported here demonstrate similar profiles of self-construal in younger and older adults from a local sample. These results additionally illustrate the need to employ multiple measures of IC and the utility of a statistical technique that may help minimize limitations of self-report measures of self-construal. By improving how we measure IC, we can expect to increase our ability to detect variables and differences associated with self-construal.

Consistent with previous studies (e.g., Elgamal et al., 2011; Kemmotsu, Enobi, & Murphy, 2013; Kempler et al., 1998), the current findings support a differential effect of age on cognitive fluency performance. The YA and OA groups did not differ on action fluency, a measure shown to be related to frontostriatal function and particularly sensitive to executive dysfunction (Signorini & Volpato, 2006). The two age groups also did not differ on letter fluency (FAS), another measure sensitive to frontal lobe dysfunction (Shimodera et al., 2012; Troyer, Moscovitch, Winocur, Alexander, & Stuss, 1998). Elgamal and colleagues reported similar findings (Elgamal et al., 2011), further explaining that older adults may actually outperform younger adults on letter fluency once accounting for processing speed.

The YA group outperformed the OA group on semantic fluency, corroborating past findings (L. J. Clark et al., 2009; Crossley, D'Arcy, & Rawson, 1997). Some have argued that word generation may depend on three primary components: verbal attention, word knowledge, and verbal long-term memory (Ruff, Light, Parker, & Levin, 1997), but that processing speed differentially modifies performance on letter and category fluency (Elgamal et al., 2011). In an fMRI study also reporting a differential effect of age on letter and category fluency, increased difficulty in the access and selection of semantic information explained problems with word retrieval (Wierenga et al., 2008). These age-related deficits in semantic fluency over phonemic fluency have been linked to right inferior and middle frontal lobe activity (Meinzer et al., 2009), further validating a more complex neural network involved in semantic fluency. Similarly, the YA group outperformed the OA group on backward digit span, a working memory task. Age-related decline in digit span has been associated with deficits in central executive processes (Grégoire & Van Der Linden, 1997) and with reduced gray matter volume in prefrontal cortex regions (Ruscheweyh et al., 2013). An effect of age was also revealed in design fluency, corroborating other research on design fluency and cognitive aging (Chi et al., 2012). While verbal fluency measures appear to rely more on lateralized frontal cortical processes, design fluency might be more dependent on bilateral frontal processes (Baldo et al., 2001). Lastly, increased age was related to poorer performance on a measure of divergent thinking (brick use test), a finding that is consistent with cross-sectional and longitudinal research on creativity and aging (McCrae, Arenberg, & Costa, 1987). A large network of various neuroanatomical regions underlie performance on divergent thinking tests of creativity. Performance on these appear to rely on gray matter volume in the prefrontal cortex, striata, and areas associated with dopaminergic mechanisms (Takeuchi et al., 2010a), but also on white matter in or adjacent to prefrontal and association cortices as well as the corpus callosum (Takeuchi et al., 2010b).

The current findings also suggest a differential effect of IC on cognition. A culture-dependent cognitive advantage is manifested in an elderly sample, but is absent in a younger adult sample. A recent meta-analysis explored the relationship between aging and brain activity during executive function tasks; the researchers describe an age-related pattern of prefrontal cortex activity during these tasks that increases with age, suggesting a greater demand for executive control with increased age (Turner & Spreng, 2012). Therefore, older individuals may experience a larger pull on cognitive resources than younger individuals fluency tasks seem to rely on more resources, regardless of overall performance (Nagels et al., 2012). Older collectivists may be more accustomed than individualists to such executive demands and, thus, are more capable of compensating for these.

Furthermore, the current findings indicate that this cognitive advantage exists in verbal measures of both action and letter fluency as well as in a switching version of a semantic fluency task, but is absent in other measures of verbal and nonverbal fluency. Given that this advantage was present in measures that rely heavily on frontal processes after controlling for verbal knowledge and was not found in other measures sensitive to executive function that involve more complex networks, these findings likely indicate culturally-divergent executive function. Speed of processing, as a core component of various neurocognitive measures, is hypothesized to be the main mediator of the relationship between aging and cognitive decline in several domains (Elgamal et al., 2011), including verbal fluency (Bryan, Luszcz, & Crawford, 1997; McDowd et al., 2011), and cannot be ignored in the context of these findings. As described previously, the role of processing speed may help explain why the effect was found in timed verbal measures, but not in those without a time constraint. However, it is unclear why this relationship was found in a measure of letter fluency and in a semantic fluency measure with a switching component, but not in other semantic fluency measures without this constraint (e.g., animals, vegetables). Evidence from imaging research has demonstrated functional overlap in letter fluency and category fluency switching, particularly through increased activation in parietal and premotor cortical regions, not seen during non-switching category fluency performance (Birn et al., 2010). This suggests that, at least physiologically, letter fluency appears to share a similar pathway with verbal switching tasks. In the context of age-related decline in verbal fluency performance, Nagels and colleagues explain the likely involvement of compensatory functions (Nagels et al., 2012). It is possible that both individualists and collectivists are able to compensate on simpler measures, but collectivists are able to compensate more than individualists on a semantic measure with a more demanding switching component. Also, other executive components may exist that affect verbal fluency performance, but are not yet well understood (McDowd et al., 2011).

These findings additionally raise some questions regarding how self-construal can play a role in applied settings. For instance, demographic variables such as race and ethnicity are more commonly accounted for, or at least documented, in clinical settings and normative samples relative to IC. However, it is unknown how much of their effect on cognitive measures is potentially mediated or moderated by self-construal. Given the dynamic nature of culture, it is difficult to ascertain how these and other demographic variables interact to paint an individual's cognitive profile. More research in this area could help answer some of these questions.

GENERAL LIMITATIONS

The current study was limited by several factors. In terms of the sample used, as shown in Table 1, both the YA and OA groups were limited in their diversity. Besides the limited scope of recruitment sources, groups were particularly restricted in relation to ethnicity and race, variables typically examined in the context of cultural differences and potentially related to self-construal. This might explain why, contrary to expectations, race and ethnicity were not related to self-construal. Extant literature on self-construal typically describes an "East-West" paradigm, comparing performances of residents in collectivist ("East") countries (e.g., Japan, China) with those of residents in individualist (West) countries (e.g., United States, United Kingdom). Beyond diversity in ethnicity and race, the sample in the current study may have lacked diversity in self-construal, therefore making additional group level differences between individualists and collectivists more difficult to detect. Future research may benefit from more heterogeneous samples.

Another potential weakness of the current study could be its limited cognitive battery. In spite of evidence that the measures administered are sensitive to cognitive decline in older adults (see L. R. Clark et al., 2012), it remains possible that not all these measures are sensitive enough to detect differences in a healthy sample of individualists and collectivists. A more expansive battery of tests that are more challenging or sensitive might aid future research. Moreover, such a battery should include other tests across a variety of domains. Extant literature has suggested a relation between self-construal and frontal lobe function (e.g., Cagigas, 2008; Kitayama & Park, 2010; Rosselli & Ardila, 2003), which has been related to other executive functions beyond those measures by the limited battery in the current study. Cultural neuroscience research utilizing neuroimaging techniques such as EEG and fMRI has also elucidated how processes and brain activation patterns may differ between cultures while performance remains equivalent between groups (Kitayama & Park, 2010; Miller & Kinsbourne, 2012). Therefore, in a similar fashion, although individualists and collectivists may perform similarly on a cognitive task, differences in process may exist. Neuropsychological tests allowing for the measure of process approaches (e.g., serial clustering versus semantic clustering in a verbal list task, global versus local attention to drawing sequence in a complex figure task) might aid in the identification of these.

Lastly, without true experimentation it is not possible to posit any causality in the relationship between self-construal and cognition. Recent literature has demonstrated the benefits of being able to prime self-construal in individuals in order to investigate the impact of IC on psychological processes. Such experimental methodology has demonstrated that evidence of differential brain activation can still be observed in those who are primed to think individualistically or collectivistically after reading a short vignette (Chiao et al., 2010). The direct effect of IC could thus be examined in the context of cognitive fluency and other neuropsychological performance using a prime/no-prime experimental design.

FUTURE DIRECTIONS

In the context of the presented aims of this research, the current study found that: (1) latent profile analysis is a useful statistical tool in the study of self-construal that maximizes shared variance in data from multiple measures in order to create a categorical latent variable that can help compare findings across studies; (2) young adult individualists and collectivists perform similarly on measures of verbal and non-verbal fluency; and (3) older adult collectivists outperform individualists on measures of verbal fluency after controlling for race, ethnicity, and linguistic ability, possibly due to a cognitive advantage in executive function. Additional research using more diverse samples, expansive cognitive batteries, and indices of processing speed is needed to further elucidate this relationship of self-construal on cognition. Nevertheless, these findings have implications for future research.

Since its inception as a distinct field of study, cultural psychology has sought to illustrate how intrinsically connected are culture and the human psyche (Shweder, 1995). Some have even argued that, with few exceptions, nearly all of our actions are mediated by a sociocultural context (Wertsch, 1995). However, culture itself is a process that requires its own analysis before it becomes operationalized in other behavioral research (Kitayama & Park, 2010). Current neuropsychological research methods typically focus on traditional demographics, primarily those including race, ethnicity, gender, and age. Although these variables have demonstrated consistent findings in much of the literature, we still do not fully grasp the mechanism underlying the role of cultural variables in cognition. Likewise, we are limited in our understanding of how these interact with other cultural variables or how other variables are similarly related to cognitive processes. Evidence suggests that culture may be operating as a higher order, top-down mechanism at the interface of neural pathways and the processing of information (Goh, Tan, & Park, 2009; Kemmotsu et al., 2013). A cultural neuroscience framework incorporating multiple factors -- micro and macro, biological and behavioral, process and performance – would aid greatly in expanding our comprehension of our increasingly diverse world. This attention to issues related to cultural diversity in our studies is likely to clarify past and future research findings.

REFERENCES

Ahl, R. E., Beiser, A., Seshadri, S., Auerbach, S., Wolf, P. A., & Au, R. (2013). Defining MCI in the Framingham Heart Study Offspring: education versus WRAT-based norms. *Alzheimer Disease and Associated Disorders*, *27*(4), 330–336. doi:10.1097/WAD.0b013e31827bde32

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In P. D. J. Kuhl & D. J. Beckmann (Eds.), *Action Control* (pp. 11–39). Springer Berlin Heidelberg. Retrieved from http://link.springer.com/chapter/10.1007/978-3-642-69746-3_2

American Psychological Association. (2002). *Guidelines on Multicultural Education, Training, Research, Practice, and Organizational Change for Psychologists*. *http://www.apa.org*. Retrieved June 16, 2014, from http://www.apa.org/pi/oema/resources/policy/multicultural-guidelines.aspx

Arnett, J. J. (2002). The psychology of globalization. *The American Psychologist*, *57*(10), 774–783.

Baldo, J. V., Shimamura, A. P., Delis, D. C., Kramer, J., & Kaplan, E. (2001). Verbal and design fluency in patients with frontal lobe lesions. *Journal of the International Neuropsychological Society: JINS*, *7*(5), 586–596.

Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. (1996). Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. *Journal of Personality Assessment*, *67*(3), 588–597.

Bengtson, V. L., & Lovejoy, M. C. (1973). Values, Personality, and Social Structure: “An Intergenerational Analysis.” *The American Behavioral Scientist*, *16*(6), 880–910.

Benton, A. L., & Hamsher, K. deS. (1978). *Multilingual Aphasia Examination* (Revised Edition.). Iowa City: Department of Neurology, University of Iowa Hospitals.

Benton, A. L., Varney, N. R., & Hamsher, K. D. (1978). Visuospatial judgment. A clinical test. *Archives of Neurology*, *35*(6), 364–367.

Berns, G., Chappelow, J., Zink, C., Pagnoni, G., Martinskurski, M., & Richards, J. (2005). Neurobiological Correlates of Social Conformity and Independence During Mental Rotation. *Biological Psychiatry*, *58*(3), 245–253. doi:10.1016/j.biopsych.2005.04.012

Berry, J. W., & Annis, R. C. (1974). Ecology, culture and psychological differentiation. *International Journal of Psychology*. *Vol 9(3)*, *9*, 173–193. doi:10.1080/00207597408247102

Birn, R. M., Kenworthy, L., Case, L., Caravella, R., Jones, T. B., Bandettini, P. A., & Martin, A. (2010). Neural systems supporting lexical search guided by letter and semantic category cues: A self-paced overt response fMRI study of verbal fluency. *NeuroImage*, *49*(1), 1099–1107. doi:10.1016/j.neuroimage.2009.07.036

Bochner, S. (1994). Cross-Cultural Differences in the Self-Concept: A Test of Hofstede's Individualism Collectivism Distinction. *Journal of Cross-Cultural Psychology*, *25*(2), 273–83.

Bolla, K. I., Gray, S., Resnick, S. M., Galante, R., & Kawas, C. (1998). Category and Letter Fluency in Highly Educated Older Adults. *The Clinical Neuropsychologist*, *12*(3), 330–338. doi:10.1076/clin.12.3.330.1986

Bond, M. H., & Cheung, T.-S. (1983). College Students' Spontaneous Self-Concept: The Effect of Culture among Respondents in Hong Kong, Japan, and the United States. *Journal of Cross-Cultural Psychology*, *14*(2), 153–171. doi:10.1177/0022002183014002002

Boone, K. B., Victor, T. L., Wen, J., Razani, J., & Pontón, M. (2007). The association between neuropsychological scores and ethnicity, language, and acculturation variables in a large patient population. *Archives of Clinical Neuropsychology: The Official Journal of the National Academy of Neuropsychologists*, *22*(3), 355–365. doi:10.1016/j.acn.2007.01.010

Bryan, J., Luszcz, M. A., & Crawford, J. R. (1997). Verbal knowledge and speed of information processing as mediators of age differences in verbal fluency performance among older adults. *Psychology and Aging*, *12*(3), 473–478.

Cabeza, R. (2001). Cognitive neuroscience of aging: contributions of functional neuroimaging. *Scandinavian Journal of Psychology*, *42*(3), 277–286.

Cagigas, X. E. (2008). *Cultural Determinants of Category Learning.* Unpublished Dissertation, University of California, San Diego, La Jolla, CA, USA.

Cardenas, V. A., Chao, L. L., Studholme, C., Yaffe, K., Miller, B. L., Madison, C., … Weiner, M. W. (2011). Brain atrophy associated with baseline and longitudinal measures of cognition. *Neurobiology of Aging*, *32*(4), 572–580. doi:10.1016/j.neurobiolaging.2009.04.011

Chee, M. W. L., Goh, J. O. S., Venkatraman, V., Tan, J. C., Gutchess, A., Sutton, B., … Park, D. (2006). Age-related changes in object processing and contextual binding revealed using fMR adaptation. *Journal of Cognitive Neuroscience*, *18*(4), 495–507. doi:10.1162/jocn.2006.18.4.495

Chen, C., Burton, M., Greenberger, E., & Dmitrieva, J. (1999). Population migration and the variation of dopamine D4 receptor (DRD4) allele frequencies around the globe. *Evolution and Human Behavior*, *20*(5), 309–324. doi:http://dx.doi.org/10.1016/S1090-5138(99)00015-X

Chen, X., Hastings, P. D., Rubin, K. H., Chen, H., Cen, G., & Stewart, S. L. (1998). Child-rearing attitudes and behavioral inhibition in Chinese and Canadian toddlers: A cross-cultural study. *Developmental Psychology*, *34*(4), 677–686. doi:10.1037/0012-1649.34.4.677

Chi, Y. K., Kim, T. H., Han, J. W., Lee, S. B., Park, J. H., Lee, J. J., … Kim, K. W. (2012). Impaired design fluency is a marker of pathological cognitive aging; results from the Korean longitudinal study on health and aging. *Psychiatry Investigation*, *9*(1), 59–64. doi:10.4306/pi.2012.9.1.59

Chiao, J. Y., & Ambady, N. (2007). *Cultural neuroscience: Parsing universality and diversity across levels of analysis.* Kitayama, Shinobu; Cohen, Dov (2007). Handbook of cultural psychology. (pp. 237-254). New York, NY, US: Guilford Press. xviii.

Chiao, J. Y., & Blizinsky, K. D. (2010). Culture-gene coevolution of individualism-collectivism and the serotonin transporter gene. *Proceedings. Biological Sciences / The Royal Society*, *277*(1681), 529–537. doi:10.1098/rspb.2009.1650

Chiao, J. Y., Harada, T., Komeda, H., Li, Z., Mano, Y., Saito, D., … Iidaka, T. (2009). Neural basis of individualistic and collectivistic views of self. *Human Brain Mapping*, *30*(9), 2813–2820. doi:10.1002/hbm.20707

Chiao, J. Y., Harada, T., Komeda, H., Li, Z., Mano, Y., Saito, D., … Iidaka, T. (2010). Dynamic cultural influences on neural representations of the self. *Journal of Cognitive Neuroscience*, *22*(1), 1–11. doi:10.1162/jocn.2009.21192

Chua, H. F., Boland, J. E., & Nisbett, R. E. (2005). Cultural variation in eye movements during scene perception. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(35), 12629–12633. doi:10.1073/pnas.0506162102

Clark, L. J., Gatz, M., Zheng, L., Chen, Y.-L., McCleary, C., & Mack, W. J. (2009). Longitudinal verbal fluency in normal aging, preclinical, and prevalent Alzheimer’s disease. *American Journal of Alzheimer’s Disease and Other Dementias*, *24*(6), 461–468. doi:10.1177/1533317509345154

Clark, L. R., Schiehser, D. M., Weissberger, G. H., Salmon, D. P., Delis, D. C., & Bondi, M. W. (2012). Specific measures of executive function predict cognitive decline in older adults. *Journal of the International Neuropsychological Society: JINS*, *18*(1), 118–127. doi:10.1017/S1355617711001524

Cohen, A. B., & Rozin, P. (2001). Religion and the morality of mentality. *Journal of Personality and Social Psychology*, *81*(4), 697–710. doi:http://dx.doi.org/10.1037/0022-3514.81.4.697

Cole, M. (1989). Cultural psychology: a once and future discipline? *Nebraska Symposium on Motivation. Nebraska Symposium on Motivation*, *37*, 279–335.

Cole, M., & Means, B. (1986). *Comparative studies of how people think: An introduction.* Cambridge, MA, US: Harvard University Press (.

Coolidge, F. L., & Wynn, T. (2001). Executive functions of the frontal lobes and the evolutionary ascendancy of homo sapiens. *Cambridge Archaeological Jounral*, *11*(2), 255–60.

Cousins, S. D. (1989). Culture and self-perception in Japan and the United States. *Journal of Personality and Social Psychology*, *56*(1), 124–131. doi:http://dx.doi.org/10.1037/0022-3514.56.1.124

Crossley, M., D'Arcy, C., & Rawson, N. S. (1997). Letter and category fluency in community-dwelling Canadian seniors: a comparison of normal participants to those with dementia of the Alzheimer or vascular type. *Journal of Clinical and Experimental Neuropsychology*, *19*(1), 52–62. doi:10.1080/01688639708403836

Davis, S. W., Dennis, N. A., Buchler, N. G., White, L. E., Madden, D. J., & Cabeza, R. (2009). Assessing the effects of age on long white matter tracts using diffusion tensor tractography. *NeuroImage*, *46*(2), 530–541. doi:10.1016/j.neuroimage.2009.01.068

Delis, D., Kaplan, E., & Kramer, J. (2001). *Delis-Kaplan Executive Function System*. San Antonio, TX: Psychological Corporation.

Dulas, M. R., & Duarte, A. (2014). Aging Affects the Interaction between Attentional Control and Source Memory: An fMRI Study. *Journal of Cognitive Neuroscience*. doi:10.1162/jocn_a_00663

Dunn, A. L., & Fox Tree, J. E. (2009). A quick, gradient Bilingual Dominance Scale. *Bilingualism: Language and Cognition*, *12*(03), 273. doi:10.1017/S1366728909990113

Eagle, M., Goldberger, L., & Breitman, M. (1969). Field dependence and memory for social vs neutral and relevant vs irrelevant incidental stimuli. *Perceptual and Motor Skills*, *29*(3), 903–910.

Elgamal, S. A., Roy, E. A., & Sharratt, M. T. (2011). Age and Verbal Fluency: The Mediating Effect of Speed of Processing. *Canadian Geriatrics Journal*, *14*(3). doi:10.5770/cgj.v14i3.17

Faul, F. (2008). G*Power [computer software] (Version 3.1.0). Kiel, Germany: Universität Kiel.

Fiske, A. P., Kitayama, S., Markus, H. R., & Nisbett, R. E. (1998). The cultural matrix of social psychology., 915–981.

Fjell, A. M., & Walhovd, K. B. (2010). Structural Brain Changes in Aging: Courses, Causes and Cognitive Consequences. *Reviews in the Neurosciences*, *21*(3), 187–222. doi:10.1515/REVNEURO.2010.21.3.187

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*(3), 189–198.

Friedman, L., Kenny, J. T., Wise, A. L., Wu, D., Stuve, T. A., Miller, D. A., … Lewin, J. S. (1998). Brain activation during silent word generation evaluated with functional MRI. *Brain and Language*, *64*(2), 231–256. doi:10.1006/brln.1998.1953

Fung, H. H., Isaacowitz, D. M., Lu, A. Y., & Li, T. (2010). Interdependent self-construal moderates the age-related negativity reduction effect in memory and visual attention. *Psychology and Aging*, *25*(2), 321–329. doi:10.1037/a0019079

Goh, J. O., Tan, J. C., & Park, D. C. (2009). Culture modulates eye-movements to visual novelty. *PloS One*, *4*(12), e8238. doi:10.1371/journal.pone.0008238

Goode, P. E., Goddard, P. H., & Pascual-Leone, J. (2002). Event-related potentials index cognitive style differences during a serial-order recall task. *International Journal of Psychophysiology: Official Journal of the International Organization of Psychophysiology*, *43*(2), 123–140.

Goto, S. G., Yee, A., Lowenberg, K., & Lewis, R. S. (2013). Cultural differences in sensitivity to social context: detecting affective incongruity using the N400. *Social Neuroscience*, *8*(1), 63–74. doi:10.1080/17470919.2012.739202

Grace, S. (2002). Sense of self in the new millennium: Male and female responses to the TST. *Social Behavior and Personality.*, *30*(3), 271.

Grant, M. M., Thase, M. E., & Sweeney, J. A. (2001). Cognitive disturbance in outpatient depressed younger adults: evidence of modest impairment. *Biological Psychiatry*, *50*(1), 35–43.

Greenfield, P. M., Keller, H., Fuligni, A., & Maynard, A. (2003). Cultural pathways through universal development. *Annual Review of Psychology. Vol 54*, *54*, 461–490.

Greenwood, P. M., & Parasuraman, R. (2010). Neuronal and Cognitive Plasticity: A Neurocognitive Framework for Ameliorating Cognitive Aging. *Frontiers in Aging Neuroscience*, *2*. doi:10.3389/fnagi.2010.00150

Grégoire, J., & Van Der Linden, M. (1997). Effect of age on forward and backward digit spans. *Aging, Neuropsychology, and Cognition*, *4*(2), 140–149. doi:10.1080/13825589708256642

Guilford, J. P., Christensen, P. R., Merrifield, P. R., & Wilson, R. C. (1978). *Alternate uses: Manual of instructions and interpretations*. Orange, CA: Sheridan Psychological Services.

Guo, X., Schwartz, S. J., & McCabe, B. E. (2008). Aging, gender, and self: Dimensionality and measurement invariance analysis on self-construal. *Self and Identity*, *7*(1), 1–24. doi:http://dx.doi.org/10.1080/15298860600926873

Harada, T., Li, Z., & Chiao, J. (2010). Differential dorsal and ventral medial prefrontal representations of the implicit self modulated by individualism and collectivism: An fMRI study. *Social Neuroscience*, *5*(3), 257–271. doi:10.1080/17470910903374895

Head, D., Rodrigue, K. M., Kennedy, K. M., & Raz, N. (2008). Neuroanatomical and Cognitive Mediators of Age-Related Differences in Episodic Memory. *Neuropsychology*, *22*(4), 491–507. doi:10.1037/0894-4105.22.4.491

Hedden, T., Ketay, S., Aron, A., Markus, H. R., & Gabrieli, J. D. E. (2008). Cultural influences on neural substrates of attentional control. *Psychological Science. Vol 19(1)*, *19*(2008), 12–17.

Hedden, T., Park, D. C., Nisbett, R., Ji, L.-J., Jing, Q., & Jiao, S. (2002). Cultural variation in verbal versus spatial neuropsychological function across the life span. *Neuropsychology. Vol 16(1)*, *16*(2002), 65–73.

Helms, J. E., Jernigan, M., & Mascher, J. (2005). The meaning of race in psychology and how to change it: a methodological perspective. *The American Psychologist*, *60*(1), 27–36. doi:10.1037/0003-066X.60.1.27

Holden, H. M., & Gilbert, P. E. (2012). Less efficient pattern separation may contribute to age-related spatial memory deficits. *Frontiers in Aging Neuroscience*, *4*, 9. doi:10.3389/fnagi.2012.00009

Hunt, E., & Agnoli, F. (1991). The Whorfian hypothesis: A cognitive psychology perspective. *Psychological Review. Vol 98(3), 98*, 377–389. doi:10.1037/0033-295X.98.3.377

Ji, L.-J., Peng, K., & Nisbett, R. E. (2000). Culture, control, and perception of relationships in the environment. *Journal of Personality and Social Psychology. Vol 78(5), 78*, 943–955. doi:10.1037/0022-3514.78.5.943

Ji, L.-J., Zhang, Z., & Nisbett, R. E. (2004). Is It Culture or Is It Language? Examination of Language Effects in Cross-Cultural Research on Categorization. *Journal of Personality and Social Psychology. Vol 87(1), 87*, 57–65. doi:10.1037/0022-3514.87.1.57

Johnson, C., Gadon, O., Carlson, D., Southwick, S., Faith, M., & Chalfin, J. (2002). Self-reference and group membership: evidence for a group-reference effect. *European Journal of Social Psychology*, *32*(2), 261–274. doi:10.1002/ejsp.83

Kaushanskaya, M., Blumenfeld, H. K., & Marian, V. (2011). The relationship between vocabulary and short-term memory measures in monolingual and bilingual speakers. *The International Journal of Bilingualism: Cross-Disciplinary, Cross-Linguistic Studies of Language Behavior*, *15*(4), 408–425. doi:10.1177/1367006911403201

Kemmotsu, N., Enobi, Y., & Murphy, C. (2013). Performance of older Japanese American adults on selected cognitive instruments. *Journal of the International Neuropsychological Society: JINS*, *19*(7), 773–781. doi:10.1017/S1355617713000520

Kempler, D., Teng, E. L., Dick, M., Taussig, I. M., & Davis, D. S. (1998). The effects of age, education, and ethnicity on verbal fluency. *Journal of the International Neuropsychological Society: JINS*, *4*(6), 531–538.

Kitayama, S., & Park, J. (2010). Cultural neuroscience of the self: understanding the social grounding of the brain. *Social Cognitive and Affective Neuroscience*, *5*(2-3), 111–129. doi:10.1093/scan/nsq052

Kitayama, S., & Uskul, A. K. (2011). Culture, Mind, and the Brain: Current Evidence and Future Directions. *Annual Review of Psychology*, *62*(1), 419–449. doi:10.1146/annurev-psych-120709-145357

Kramer, J. H., Mungas, D., Reed, B. R., Wetzel, M. E., Burnett, M. M., Miller, B. L., … Chui, H. C. (2007). Longitudinal MRI and Cognitive Change in Healthy Elderly. *Neuropsychology*, *21*(4), 412–418. doi:10.1037/0894-4105.21.4.412

Kuhn, M. H., & McPartland, T. S. (1954). An empirical investigation of self-attitudes. *American Sociological Review*, *19*, 68–76.

Lahat, A., Todd, R. M., Mahy, C. E. V., Lau, K., & Zelazo, P. D. (2010). Neurophysiological Correlates of Executive Function: A Comparison of European-Canadian and Chinese-Canadian 5-Year-Old Children. *Frontiers in Human Neuroscience*, *3*. doi:10.3389/neuro.09.072.2009

Langenecker, S. A., Bieliauskas, L. A., Rapport, L. J., Zubieta, J.-K., Wilde, E. A., & Berent, S. (2005). Face emotion perception and executive functioning deficits in depression. *Journal of Clinical and Experimental Neuropsychology*, *27*(3), 320–333. doi:10.1080/13803390490490515720

Langenecker, S. A., Lee, H. J., & Bieliauskas, L. A. (2009). *Neuropsychology of depression and related mood disorders.* Grant, Igor; Adams, Kenneth M. (2009). Neuropsychological assessment of neuropsychiatric and neuromedical disorders (3rd ed.). (pp. 523-559). New York, NY, US: Oxford University Press. xvi.

Lanza, S. T., Flaherty, B. P., & Collins, L. M. (2003). *Latent class and latent transition analysis.* Schinka, John A.; Velicer, Wayne F. (2003). Handbook of psychology: Research methods in psychology.

Lewis, R. S., Goto, S. G., & Kong, L. L. (2008). Culture and context: East Asian American and European American differences in P3 event-related potentials and self-construal. *Personality & Social Psychology Bulletin*, *34*(5), 623–634. doi:10.1177/0146167207313731

Lezak, M. D. (1982). The Problem of Assessing Executive Functions. *International Journal of Psychology*, *17*(1-4), 281–297. doi:10.1080/00207598208247445

Lezak, M. D., Howieson, D. B., Loring, D. W., Hannay, H. J., & Fischer, J. S. (2004). *Neuropsychological assessment (4th ed.).* New York, NY, US: Oxford University Press.

Lieberman, M. D., Jarcho, J. M., & Obayashi, J. (2005). Attributional inference across cultures: similar automatic attributions and different controlled corrections. *Personality & Social Psychology Bulletin*, *31*(7), 889–901. doi:10.1177/0146167204274094

Lonner, W. J., & Berry, J. W. (1986). *Field methods in cross-cultural research.* Cross-cultural research and methodology series, Vol. 8. Thousand Oaks, CA, US: Sage Publications.

Lubke, G. H., & Muthén, B. (2005). Investigating population heterogeneity with factor mixture models. *Psychological Methods*, *10*(1), 21–39. doi:10.1037/1082-989X.10.1.21

Manly, J. J., Schupf, N., Tang, M.-X., & Stern, Y. (2005). Cognitive decline and literacy among ethnically diverse elders. *Journal of Geriatric Psychiatry and Neurology*, *18*(4), 213–217. doi:10.1177/0891988705281868

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review. Vol 98(2), 98*, 224–253.

Masuda, T., & Nisbett, R. E. (2001). Attending holistically versus analytically: Comparing the context sensitivity of Japanese and Americans. *Journal of Personality and Social Psychology. Vol 81(5), 81*, 922–934. doi:10.1037/0022-3514.81.5.922

Mattay, V. S., Fera, F., Tessitore, A., Hariri, A. R., Berman, K. F., Das, S., … Weinberger, D. R. (2006). Neurophysiological correlates of age-related changes in working memory capacity. *Neuroscience Letters*, *392*(1-2), 32–37. doi:10.1016/j.neulet.2005.09.025

Mattli, F., Schnitzspahn, K. M., Studerus-Germann, A., Brehmer, Y., & Zöllig, J. (2014). Prospective memory across the lifespan: Investigating the contribution of retrospective and prospective processes. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, *21*(5), 515–543. doi:10.1080/13825585.2013.837860

McCrae, R. R., Arenberg, D., & Costa, P. T. (1987). Declines in divergent thinking with age: cross-sectional, longitudinal, and cross-sequential analyses. *Psychology and Aging*, *2*(2), 130–137.

McDowd, J., Hoffman, L., Rozek, E., Lyons, K. E., Pahwa, R., Burns, J., & Kemper, S. (2011). Understanding verbal fluency in healthy aging, Alzheimer’s disease, and Parkinson’s disease. *Neuropsychology*, *25*(2), 210–225. doi:http://dx.doi.org/10.1037/a0021531

McGinnis, S. M., Brickhouse, M., Pascual, B., & Dickerson, B. C. (2011). Age-Related Changes in the Thickness of Cortical Zones in Humans. *Brain Topography*, *24*(3-4), 279–291. doi:10.1007/s10548-011-0198-6

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of Mood States*. San Diego, CA: Educational and Industrial Testing Service.

Meinzer, M., Flaisch, T., Wilser, L., Eulitz, C., Rockstroh, B., Conway, T., … Crosson, B. (2009). Neural signatures of semantic and phonemic fluency in young and old adults. *Journal of Cognitive Neuroscience*, *21*(10), 2007–2018. doi:10.1162/jocn.2009.21219

Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review. Vol 63(2), 63*, 81–97.

Miller, J. G., & Kinsbourne, M. (2012). Culture and Neuroscience in Developmental Psychology: Contributions and Challenges: Culture and Neuroscience in Developmental Psychology. *Child Development Perspectives*, *6*(1), 35–41. doi:10.1111/j.1750-8606.2011.00188.x

Mistry, J., & Rogoff, B. (1994). Remembering in cultural context. In W. Lonner & R. Malpass (Eds.), *Psychology and Culture* (pp. 139–44). Boston, MA: Allyn Bacon.

Mitchell, A. J. (2009). A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment. *Journal of Psychiatric Research*, *43*(4), 411–431. doi:10.1016/j.jpsychires.2008.04.014

Moran, J. M., Jolly, E., & Mitchell, J. P. (2012). Social-cognitive deficits in normal aging. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, *32*(16), 5553–5561. doi:10.1523/JNEUROSCI.5511-11.2012

Murray, M. E., Senjem, M. L., Petersen, R. C., Hollman, J. H., Preboske, G. M., Weigand, S. D., … Jack, C. R., Jr. (2010). Functional impact of white matter hyperintensities in cognitively normal elderly subjects. *Archives of Neurology*, *67*(11), 1379–1385. doi:10.1001/archneurol.2010.280

Muthén, L. K., & Muthén, B. O. (2010). *Mplus User's Guide. Sixth Edition*. Los Angeles, CA: Muthén & Muthén.

Na, J., Grossmann, I., Varnum, M. E. W., Kitayama, S., Gonzalez, R., & Nisbett, R. E. (2010). Cultural differences are not always reducible to individual differences. *Proceedings of the National Academy of Sciences*, *107*(14), 6192–6197. doi:10.1073/pnas.1001911107

Nagels, A., Kircher, T., Dietsche, B., Backes, H., Marquetand, J., & Krug, A. (2012). Neural processing of overt word generation in healthy individuals: the effect of age and word knowledge. *NeuroImage*, *61*(4), 832–840. doi:10.1016/j.neuroimage.2012.04.019

Naito, M. (2003). The relationship between theory of mind and episodic memory: evidence for the development of autonoetic consciousness. *Journal of Experimental Child Psychology*, *85*(4), 312–336.

Nisbett, R. E., & Cohen, D. (1996). Culture of honor: The psychology of violence in the South., xviii, 119.

Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review. Vol 108(2)*, *108*, 291–310.

O'Bryant, S. E., O'Jile, J. R., & McCaffrey, R. J. (2004). Reporting of demographic variables in neuropsychological research: trends in the current literature. *The Clinical Neuropsychologist*, *18*(2), 229–233. doi:10.1080/13854040490501439

Oyserman, D. (2002). Rethinking Individualism and Collectivism: Evaluation of Theoretical Assumptions and Meta-Analyses. *Psychological Bulletin.*, *128*(1), 3.

Paelecke-Habermann, Y., Pohl, J., & Leplow, B. (2005). Attention and executive functions in remitted major depression patients. *Journal of Affective Disorders*, *89*(1-3), 125–135. doi:10.1016/j.jad.2005.09.006

Peltz, C. B., Gratton, G., & Fabiani, M. (2011). Age-Related Changes in Electrophysiological and Neuropsychological Indices of Working Memory, Attention Control, and Cognitive Flexibility. *Frontiers in Psychology*, *2*. doi:10.3389/fpsyg.2011.00190

Peng, K., Nisbett, R. E., & Wong, N. Y. C. (1997). Validity problems comparing values across cultures and possible solutions. *Psychological Methods. Vol 2(4)*, *2*, 329–344.

Pfeifer, J. H., Lieberman, M. D., & Dapretto, M. (2007). "I know you are but what am I?!": neural bases of self- and social knowledge retrieval in children and adults. *Journal of Cognitive Neuroscience*, *19*(8), 1323–1337. doi:10.1162/jocn.2007.19.8.1323

Pfeifer, J. H., Masten, C. L., Borofsky, L. A., Dapretto, M., Fuligni, A. J., & Lieberman, M. D. (2009). Neural correlates of direct and reflected self-appraisals in adolescents and adults: when social perspective-taking informs self-perception. *Child Development*, *80*(4), 1016–1038. doi:10.1111/j.1467-8624.2009.01314.x

Piatt, A. L., Fields, J. A., Paolo, A. M., & Tröster, A. I. (1999). Action (verb naming) fluency as an executive function measure: Convergent and divergent evidence of validity. *Neuropsychologia. Vol 37(13)*, *37*, 1499–1503.

Podell, J. E., Sambataro, F., Murty, V. P., Emery, M. R., Tong, Y., Das, S., … Mattay, V. S. (2012). Neurophysiological correlates of age-related changes in working memory updating. *NeuroImage*, *62*(3), 2151–2160. doi:10.1016/j.neuroimage.2012.05.066

Porter, R. J., Gallagher, P., Thompson, J. M., & Young, A. H. (2003). Neurocognitive impairment in drug-free patients with major depressive disorder. *The British Journal of Psychiatry: The Journal of Mental Science*, *182*, 214–220.

Raz, N. (2000). *Aging of the brain and its impact on cognitive performance: Integration of structural and functional findings.* Craik, Fergus I. M.; Salthouse, Timothy A.

(2000). The handbook of aging and cognition (2nd ed.). (pp. 1-90). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers. ix.

Raz, N., Ghisletta, P., Rodrigue, K. M., Kennedy, K. M., & Lindenberger, U. (2010). Trajectories of brain aging in middle-aged and older adults: regional and individual differences. *NeuroImage*, *51*(2), 501–511. doi:10.1016/j.neuroimage.2010.03.020

Reuter-Lorenz, P. A., Jonides, J., Smith, E. E., Hartley, A., Miller, A., Marshuetz, C., & Koeppe, R. A. (2000). Age differences in the frontal lateralization of verbal and spatial working memory revealed by PET. *Journal of Cognitive Neuroscience*, *12*(1), 174–187.

Rhee, E., Uleman, J. S., Lee, H. K., & Roman, R. J. (1995). Spontaneous self-descriptions and ethnic identities in individualistic and collectivistic cultures. *Journal of Personality and Social Psychology. Vol 69(1)*, *69*, 142–152. doi:10.1037/0022-3514.69.1.142

Roesch, S. C., Villodas, M., & Villodas, F. (2010). Latent class/profile analysis in maltreatment research: A commentary on Nooner et al., Pears et al., and looking beyond. *Child Abuse & Neglect. Vol 34(3)*, *34*, 155–160. doi:10.1016/j.chiabu.2010.01.003

Rose, E. J., & Ebmeier, K. P. (2006). Pattern of impaired working memory during major depression. *Journal of Affective Disorders*, *90*(2-3), 149–161. doi:10.1016/j.jad.2005.11.003

Rosselli, M., & Ardila, A. (2003). The impact of culture and education on non-verbal neuropsychological measurements: A critical review. *Brain and Cognition*, *52*(3), 326–333. doi:10.1016/S0278-2626(03)00170-2

Rothbaum, F., Weisz, J., Pott, M., Miyake, K., & Morelli, G. (2000). Attachment and culture: Security in the United States and Japan. *American Psychologist. Vol 55(10)*, *55*, 1093–1104.

Ruff, R. M., Light, R. H., Parker, S. B., & Levin, H. S. (1997). The psychological construct of word fluency. *Brain and Language*, *57*(3), 394–405. doi:10.1006/brln.1997.1755

Ruscheweyh, R., Deppe, M., Lohmann, H., Wersching, H., Korsukewitz, C., Duning, T., … Knecht, S. (2013). Executive performance is related to regional gray matter volume in healthy older individuals. *Human Brain Mapping*, *34*(12), 3333–3346. doi:10.1002/hbm.22146

Sabbagh, M. A., Xu, F., Carlson, S. M., Moses, L. J., & Lee, K. (2006). The Development of Executive Functioning and Theory of Mind. *Psychological Science*, *17*(1), 74–81. doi:10.1111/j.1467-9280.2005.01667.x

Salat, D. H., Greve, D. N., Pacheco, J. L., Quinn, B. T., Helmer, K. G., Buckner, R. L., & Fischl, B. (2009). Regional white matter volume differences in nondemented aging and Alzheimer's disease. *NeuroImage*, *44*(4), 1247–1258. doi:10.1016/j.neuroimage.2008.10.030

Salmon, D. P., Riekkinen, P. J., Katzman, R., Zhang, M. Y., Jin, H., & Yu, E. (1989). Cross-cultural studies of dementia. A comparison of mini-mental state examination performance in Finland and China. *Archives of Neurology*, *46*(7), 769–772.

Santamaria, A., de la Mata, M. L., Hansen, T. G. B., & Ruiz, L. (2010). Cultural Self-Construals of Mexican, Spanish, and Danish College Students: Beyond Independent and Interdependent Self. *Journal of Cross-Cultural Psychology*, *41*(3), 471–477. doi:10.1177/0022022109359694

Shavitt, S., Torelli, C., & Riemer, H. (Forthcoming). Horizontal and Vertical Individualism and Collectivism: Implications for Understanding Psychological Processes. In M. Gelfand, C. Chiu, & Y. Hong (Eds.), *Advances in Culture and Psychology* (pp. 309–350). Oxford University Press.

Sheikh, A. (2006). Why are ethnic minorities under-represented in US research studies? *PLoS Medicine*, *3*(2), e49. doi:10.1371/journal.pmed.0030049

Sheikh, J. I., & Yesavage, J. A. (1986). Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. *Clinical Gerontologist: The Journal of Aging and Mental Health. Vol 5(1-2)*, *5*(1986), 165–173. doi:10.1300/J018v05n01_09

Shimodera, S., Imai, Y., Kamimura, N., Morokuma, I., Fujita, H., Inoue, S., & Furukawa, T. A. (2012). Mapping hypofrontality during letter fluency task in schizophrenia: a multi-channel near-infrared spectroscopy study. *Schizophrenia Research*, *136*(1-3), 63–69. doi:10.1016/j.schres.2012.01.039

Shweder, R. (1995). Cultural psychology: What is it?, 41–86.

Signorini, M., & Volpato, C. (2006). Action fluency in Parkinson's disease: a follow-up study. *Movement Disorders: Official Journal of the Movement Disorder Society*, *21*(4), 467–472. doi:10.1002/mds.20718

Simons, D. J., & Levin, D. T. (1997). Change blindness. *Trends in Cognitive Sciences. Vol 1(7)*, *1*, 261–267. doi:10.1016/S1364-6613(97)01080-2

Smarr, K. L., & Keefer, A. L. (2011). Measures of depression and depressive symptoms: Beck Depression Inventory-II (BDI-II), Center for Epidemiologic Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS), Hospital Anxiety and Depression Scale (HADS), and Patient Health Questionnaire-9 (PHQ-9). *Arthritis Care & Research*, *63 Suppl 11*, S454–466. doi:10.1002/acr.20556

SPSS, Inc. (2009). PASW Statistics 18 (Version 18.0.0). Chicago, IL: SPSS, Inc.

Stephenson, M. (2000). Development and validation of the Stephenson Multigroup Acculturation Scale (SMAS). *Psychological Assessment*, *12*(1), 77–88.

Suchy, Y., Kraybill, M. L., & Gidley Larson, J. C. (2010). Understanding design fluency: motor and executive contributions. *Journal of the International Neuropsychological Society: JINS*, *16*(1), 26–37. doi:10.1017/S1355617709990804

Takeuchi, H., Taki, Y., Sassa, Y., Hashizume, H., Sekiguchi, A., Fukushima, A., & Kawashima, R. (2010a). Regional gray matter volume of dopaminergic system associate with creativity: evidence from voxel-based morphometry. *NeuroImage*, *51*(2), 578–585. doi:10.1016/j.neuroimage.2010.02.078

Takeuchi, H., Taki, Y., Sassa, Y., Hashizume, H., Sekiguchi, A., Fukushima, A., & Kawashima, R. (2010b). White matter structures associated with creativity: evidence from diffusion tensor imaging. *NeuroImage*, *51*(1), 11–18. doi:10.1016/j.neuroimage.2010.02.035

Tang, Y., Zhang, W., Chen, K., Feng, S., Ji, Y., Shen, J., … Liu, Y. (2006). Arithmetic processing in the brain shaped by cultures. *PNAS Proceedings of the National Academy of Sciences of the United States of America*, *103*(28), 10755–10780. doi:http://dx.doi.org/10.1073/pnas.0604416103

Tolentino, J. C., Pirogovsky, E., Luu, T., Toner, C. K., & Gilbert, P. E. (2012). The effect of interference on temporal order memory for random and fixed sequences in nondemented older adults. *Learning & Memory (Cold Spring Harbor, N.Y.)*, *19*(6), 251–255. doi:10.1101/lm.026062.112

Tombaugh, T. N., & McIntyre, N. J. (1992). The mini-mental state examination: a comprehensive review. *Journal of the American Geriatrics Society*, *40*(9), 922–935.

Trafimow, D., Triandis, H. C., & Goto, S. G. (1991). Some tests of the distinction between the private self and the collective self. *Journal of Personality and Social Psychology. Vol 60(5)*, *60*, 649–655. doi:10.1037/0022-3514.60.5.649

Triandis, H. (1996). The Psychological Measurement of Cultural Syndromes. *American Psychologist*, *51*(4), 407–15.

Triandis, H. (1998). Converging Measurement of Horizontal and Vertical Individualism and Collectivism. *Journal of Personality and Social Psychology.*, *74*(1), 118.

Triandis, H., Bontempo, R., Betancourt, H., Bond, M., Leung, K., Brenes, A., … de Montmollin, G. (1986). The measurement of the etic aspects of individualism and collectivism across cultures. *Australian Journal of Psychology*, *38*(3), 257–267. doi:10.1080/00049538608259013

Troyer, A. K., Moscovitch, M., & Winocur, G. (1997). Clustering and switching as two components of verbal fluency: evidence from younger and older healthy adults. *Neuropsychology*, *11*(1), 138–146.

Troyer, A. K., Moscovitch, M., Winocur, G., Alexander, M. P., & Stuss, D. (1998). Clustering and switching on verbal fluency: the effects of focal frontal- and temporal-lobe lesions. *Neuropsychologia*, *36*(6), 499–504.

Turner, G. R., & Spreng, R. N. (2012). Executive functions and neurocognitive aging: dissociable patterns of brain activity. *Neurobiology of Aging*, *33*(4), 826.e1–13. doi:10.1016/j.neurobiolaging.2011.06.005

US Census Bureau. (2010). *2010 Census Data*. Retrieved June 4, 2012, from http://2010.census.gov/2010census/

Varnum, M. E. W., Grossmann, I., Kitayama, S., & Nisbett, R. E. (2010). The Origin of Cultural Differences in Cognition: Evidence for the Social Orientation Hypothesis. *Current Directions in Psychological Science : A Journal of the American Psychological Society*, *19*(1), 9–13. doi:10.1177/0963721409359301

Wang, Q. (2001). Culture effects on adults' earliest childhood recollection and self-description: Implications for the relation between memory and the self. *Journal of Personality and Social Psychology*, *81*(2), 220–233. doi:10.1037/0022-3514.81.2.220

Watkins, D. (1997). The Twenty Statements Test: Some Measurement Issues. *Journal of Cross-Cultural Psychology.*, *28*(5), 626.

Wendler, D., Kington, R., Madans, J., Van Wye, G., Christ-Schmidt, H., Pratt, L. A., … Emanuel, E. (2006). Are racial and ethnic minorities less willing to participate in health research? *PLoS Medicine*, *3*(2), e19. doi:10.1371/journal.pmed.0030019

Wertsch, J. V. (1995). Sociocultural Research in the Copyright Age. *Culture & Psychology*, *1*(1), 81–102. doi:10.1177/1354067X9511006

Whorf, B. L. (1956). *Language, thought, and reality: selected writings.* Technology Press of Massachusetts Institute of Technology: Cambridge.

Wierenga, C. E., Benjamin, M., Gopinath, K., Perlstein, W. M., Leonard, C. M., Rothi, L. J. G., … Crosson, B. (2008). Age-related changes in word retrieval: role of bilateral frontal and subcortical networks. *Neurobiology of Aging*, *29*(3), 436–451. doi:10.1016/j.neurobiolaging.2006.10.024

Wilkinson, G. S., & Robertson, G. J. (2006). *WRAT4: Wide Range Achievement Test*. Psychological Assessment Resources.

Witkin, H. A., & Berry, J. W. (1975). Psychological differentiation in cross-cultural perspective. *Journal of Cross-Cultural Psychology. Vol 6(1)*, *6*, 4–87.

Witkin, H. A., & Goodenough, D. R. (1977). Field dependence and interpersonal behavior. *Psychological Bulletin. Vol 84(4)*, *84*, 661–689. doi:10.1037/0033-2909.84.4.661

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1982). Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of Psychiatric Research*, *17*(1), 37–49.

Zhu, Y., Zhang, L., Fan, J., & Han, S. (2007). Neural basis of cultural influence on self-representation. *NeuroImage*, *34*(3), 1310–1316. doi:10.1016/j.neuroimage.2006.08.047

Ziegler, D. A., Piguet, O., Salat, D. H., Prince, K., Connally, E., & Corkin, S. (2010). Cognition in healthy aging is related to regional white matter integrity, but not cortical thickness. *Neurobiology of Aging*, *31*(11), 1912–1926. doi:10.1016/j.neurobiolaging.2008.10.015