 <p>UniSR Università Vita-Salute San Raffaele</p>	<p>CANDIDATURA A SUPERVISORE E PROPOSTA PROGETTO DI RICERCA</p> <p>CANDIDACY AS SUPERVISOR & RESEARCH PROJECT</p>	<p>MO 47-27 rev. 00 del 12/01/2023 PO 47 Pag. 4 di 11</p>
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PROGETTO 1/ PROJECT 1

Supervisore/Supervisor Prof. Jubin Abutalebi

Titolo/Title: Sleep, bilingualism, and cognition

Corso /PhD Course: Scienze Cognitive e Comportamentali/Cognitive and Behavioral Sciences


Curriculum: _____

Link alla pagina personale OSR/UNISR/ <https://www.unisr.it/ricerca/centri/cnpl>
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Descrizione del progetto/Project description (Tra i 2.000 e 3.000 caratteri spazi inclusi/ Number of characters, including spaces: 2.000 - 3.000):

Sleep and language are central human experiences. We spend approximately one third of our life sleeping and most of our life communicating: most of us, in more than one language. Sleep and bilingualism display several contact points. They are both known to deeply affect our cognition, and indeed very similar aspects of it, namely executive functioning, attention and memory. Interestingly, while bilingualism is mostly discussed with regard to its beneficial effects on cognition, sleep – or rather disturbances related to it – is usually discussed in the context of its detrimental effects on cognition. Sleep and bilingualism and their impact upon cognitive efficiency are central to this research proposal. Cognitive efficiency is impacted by various factors, for example, nutrition, exercise, sleep, meditation, mnemonics, and technologies. In recent years, researchers have provided increasing evidence that bilingualism might also influence general cognitive efficiency. Among the factors mentioned above that are known to promote cognitive efficiency, bilingualism can be the most relevant one because it is widespread throughout the world. In fact, more than one half of the world population is bilingual. In this way potential effects of bilingualism on cognition may influence a huge share of the population, possibly more than the amount of people in the world that exercise, play music instruments or video games. Substantial behavioral and neuroimaging evidence showing that two languages in the bilingual mind are always activated during language use (Kroll et al., 2015). Thus, bilinguals must persistently resolve cross-linguistic conflict to achieve successful communication. It requires a special cognitive mechanism of selection, inhibition and switching known as ‘language control’, which is managed by a network of cortico-subcortical regions (Abutalebi & Green, 2007, 2013, 2016). It is assumed that due to cognitive and neural overlap between bilingual language control and general executive control, domain-general systems become more efficient in multilinguals (Bialystok et al., 2009; Bialystok, 2017; Kroll et al., 2015).

Another factor that is known to affect cognitive efficiency is sleep quality. Sleep constitutes a large proportion of the human lifetime. There is no argument that sleep plays an essential role for day-to-

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day life and across a range of physiological and cognitive functions (Dresler et al., 2013). Meanwhile not obtaining enough sleep impairs a wide variety of cognitive functions such as attention, language, reasoning, decision making, learning and memory (Grosjean, 2021). Of interest, some crucial brain structures involved in executive functioning are known to be influenced by these two factors central to the research proposal: for example, the Caudate Nucleus (CN) *is* implicated both in general (Douglas et al., 2018) and language specific (Green & Abutalebi, 2013; Abutalebi et al., 2013) attentional control as well as in attention-related deficits. Also the CN is implicated in sleep: bilateral lesions of the CN lead to poorer memory consolidation via affecting REM and deep slow-wave sleep (Stoffers et al., 2014; van den Berg et al, 2022, Jones et al., 2022).

In this research proposal, we are going to investigate the interaction between bilingualism and sleep quality upon cognitive efficiency. Behavioral, structural, and functional neuroimaging studies focusing on attention and executive functions will be carried out in middle-aged individuals (n = 80) with and without sleep disturbances. The degree of bilingualism will be calculated, and interactions between cognitive efficiency, sleep quality and degree of bilingualism will be carried out. To the best of our knowledge, this is the first study of its kind addressing this interesting topic.

Competenze che deve acquisire lo studente/skills to be acquired by the student (Max 600 caratteri spazi inclusi/ *Number of characters, including spaces: max 600*):

- Acquisition and analysis of behavioral and psychophysiological data
- Acquisition and analysis of fMRI data Scientific writing
- Autonomy and integrity in scientific research (i.e. responsible data collection, handling, sharing, communication and reporting; fundraising and management; open science policies)

Bibliografia/References (max. 15)

Abutalebi, J., & Green, D. (2007). Bilingual language production: The neurocognition of language representation and control. *Journal of Neurolinguistics*, 20(3), 242–275.


<https://doi.org/10.1016/j.jneuroling.2006.10.003>

Abutalebi, J., & Green, D. W. (2016). Neuroimaging of language control in bilinguals: neural adaptation and reserve. *Bilingualism: Language and Cognition*, 19(4), 689–698.

<https://doi.org/10.1017/s1366728916000225>

Bialystok, E., Craik, F. I., Green, D. W., & Gollan, T. H. (2009). Bilingual Minds. *Psychological Science in the Public Interest*, 10(3), 89–129. <https://doi.org/10.1177/1529100610387084>

Bialystok, E. (2017). The bilingual adaptation: How minds accommodate experience. *Psychological bulletin*, 143(3), 233.

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Douglas, P. K., Gutman, B., Anderson, A., Larios, C., Lawrence, K. E., Narr, K., ... & Bookheimer, S. Y. (2018). Hemispheric brain asymmetry differences in youths with attention-deficit/hyperactivity disorder. *NeuroImage: Clinical*, 18, 744-752.

Dresler, M., Sandberg, A., Ohla, K., Bublitz, C., Trenado, C., Mroczko-Wąsowicz, A., ... & Repantis, D. (2013). Non-pharmacological cognitive enhancement. *Neuropharmacology*, 64, 529-543.

Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of cognitive psychology*, 25(5), 515-530.

Grosjean, F. (2021). The Extent of Bilingualism. In *Life as a Bilingual: Knowing and Using Two or More Languages* (pp. 27-39). Cambridge: Cambridge University Press. doi:10.1017/9781108975490.003

Jones, N. F., & Ikuta, T. (2022). Sleep duration is associated with Caudate volume and executive function. *Brain Imaging and Behavior*, 16(6), 2601-2607.

Kroll, J. F., Dussias, P. E., Bice, K., & Perrotti, L. (2015). Bilingualism, Mind, and Brain. *Annual Review of Linguistics*, 1(1), 377-394. <https://doi.org/10.1146/annurev-linguist-030514-124937>

Stoffers, D., Altena, E., van der Werf, Y. D., Sanz-Arigita, E. J., Voorn, T. A., Astill, R. G., ... & Van Someren, E. J. (2014). The caudate: a key node in the neuronal network imbalance of insomnia?. *Brain*, 137(2), 610-620.

van den Berg, N. H., Pozzobon, A., Fang, Z., Al-Kuwatli, J., Toor, B., Ray, L. B., & Fogel, S. M. (2022). Sleep enhances consolidation of memory traces for complex problem-solving skills. *Cerebral Cortex*, 32(4), 653-667.

