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Objective: Over the past decade, resting state functional connectivity has shown great promise as a diagnostic and prognostic tool when applied to neurological and psychiatric populations. For example, the integrity of the default mode network – among other large-scale brain networks – has emerged as a common target of neurological disease and psychopathology. Despite this explosion in research, relatively little is understood about the cognitive characteristics of the mind at rest, and most inquiries have relied on retrospective self-report questionnaires that pose challenges for clinical populations with memory or metacognitive deficits. Understanding how different people mentally structure their idle thoughts may shed light on existing clinical neuroscience findings. Furthermore, the resting state is common context in daily life, and the lack of external stimulation during rest periods may foster the emergence of dysfunctional and/or impoverished thoughts for individuals with mental health or neurological conditions. Considering these important gaps, we conducted a line of research quantifying clinical and demographic sources of variability in resting state cognition.
Participants and Methods: Across three studies, resting state cognition was captured by training adults to voice aloud their thoughts in real time across 7-10 minute rest periods in the lab, the MRI scanner, and participants' own home. Participants were audio recorded using this think aloud technique, while efforts to minimize thought censorship were also employed. Audio-recorded speech was then transcribed and analyzed for content and dynamic characteristics by external coders and automated text analysis. Relevant characteristics were isolated and examined in relation to variability across participants in trait rumination, divergent thinking (a measure of creativity assessed with a separate Alternate Uses Task), as well as age.
Results: Across studies, the think aloud paradigm in resting state contexts showed promising ecological validity. Participants reported a low degree of thought censorship and a moderate-to-high degree of similarity of thoughts to everyday life. Additionally, total word counts across the transcripts were similar to typical rates of natural speech.
Notable variability across participants also emerged in the content and dynamic characteristics of resting state thought. Increased trait rumination was associated with the emergence of brooding in real time, including a) more negative, self-focused, and past-oriented thoughts, as well as b) dynamic signatures marked by an attraction towards negative conceptual states, and c) a narrowing of conceptual scope following negative content. In contrast, more creative individuals exhibited a pattern of exploration and curiosity in their idle thoughts, with thought transitions characterized as more loosely associative. Finally, older adults generated more linguistic diversity in their use of positive emotional words (a novel marker of emotional granularity), accompanied by increases in psychological well-being.
Conclusions: Taken together, these studies highlight substantial demographic and clinical sources of variability in resting state cognition, with important implications for resting state functional connectivity findings. They also offer a promising methodological tool and theoretical framework to promote further research in neuropsychology and related fields.

Categories: Cognitive Neuroscience
Keyword 1: creativity
Keyword 2: emotional processes
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Symposium 04: Innovative Ways of Applying Digital Technology in Neuropsychology - A Sneak Peak into the Future

11:45am - 1:15pm
Thursday, 2nd February, 2023
Town & Country Ballroom D

Chair

Michelle Madore
Stanford University School of Medicine, Stanford, USA

Discussant

Yakeel Quiroz
Massachusetts General Hospital, Boston, USA

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Summary Abstract:
The explosion of digital technology in the past decade has led to unprecedented possibilities towards improving cognitive assessment and understanding brain health. Digital technology encompasses using a multitude of devices, such as laptops, smartphones, etc, to collect health-related data. The settings can be varied to include in-clinic, remote/virtual, or a combination of hybrid models for data collection. Data can be collected at a single time point or over a continued period of time. Furthermore, the unique combination of devices used, settings, and methods of collecting digital data can become even more exclusive against the backdrop of the 'purpose' for conducting the digital study. This symposium, consisting of four abstracts, brings together the unique combination of digital studies with exclusive devices, methodologies, settings, and purposes. The topics range from how smartphone-based assessments can be applied to understand the interaction between day-to-day variability in sleep and cognition, to the use of computerized testing to investigate the associations between cognitive performance and markers of brain pathology (e.g. amyloid and tau status), to understanding cognition from an open-source smartphone application to passively and continuously capture sensor data including global positioning system trajectories, to the development and validation of an online simulated money management credit card task, and to determining the effects of cognitive rehabilitation via digital technology on cognition, neuropsychiatric symptoms, and memory strategies.
Keyword 1: brain function
Keyword 2: technology
Keyword 3: teleneuropsychology

1 What Can we Learn from High Frequency Smartphone-Based Cognitive Assessments?

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Objective: Smartphone-based cognitive assessments can provide unique information about cognition that is difficult or impossible with traditional cognitive assessments. Using high-frequency measurement "burst" designs, we have shown that older adults are capable and willing to participate in smartphone-based research, that this method dramatically improves between-subject reliability compared to traditional methods and demonstrates extraordinary test-retest reliabilities, and that high-frequency measurement can reveal time of day effects that are increased in those with elevated Alzheimer's disease biomarkers. In this symposium session, we will provide an overview of our current work in older adults at risk for AD and highlight new analyses on the interaction between day to day variability in sleep and cognition. We will also cover our approach for measuring smartphone latencies, a critical aspect of bring-your-own-device (BYOD) studies.
Participants and Methods: The Ambulatory Research in Cognition (ARC) smartphone application for iOS and Android administers custom-designed tests of associate memory, processing speed, and spatial working memory. ARC uses a measurement burst design in which very brief (typically 60s or less) tests are completed at random times several times per day for up to one week. Measurement burst designs rely on principles from ecological momentary assessment, and can be described with a simple formula: 1. Test often and everywhere, 2. Keep assessments brief, and 3. Combine the data across sessions to increase reliability. At the Knight Alzheimer's Disease Research Center at Washington University in St Louis, we have enrolled over 400 participants (ages 60-99 years) at risk for AD in ARC studies. These participants are comprehensively assessed with traditional cognitive tests, clinical examinations, neuroimaging, and fluid biomarkers. ARC also assesses sleep with the Pittsburgh Sleep Quality Index that captures essential sleep parameters, which are assessed daily during each 7-day measurement burst. Analyses of sleep and cognition focused on parameters including total sleep time, number of awakenings, sleep quality ratings, and an extremes analysis comparing cognition after nights with more sleep and after nights with less sleep.
Results: Overall, participants reporting less total sleep time and more awakenings had lower memory and processing speed scores. This

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