Digitalization, tele-health, and neurocognitive empowerment
Case studies and methodological remarks from an emerging field

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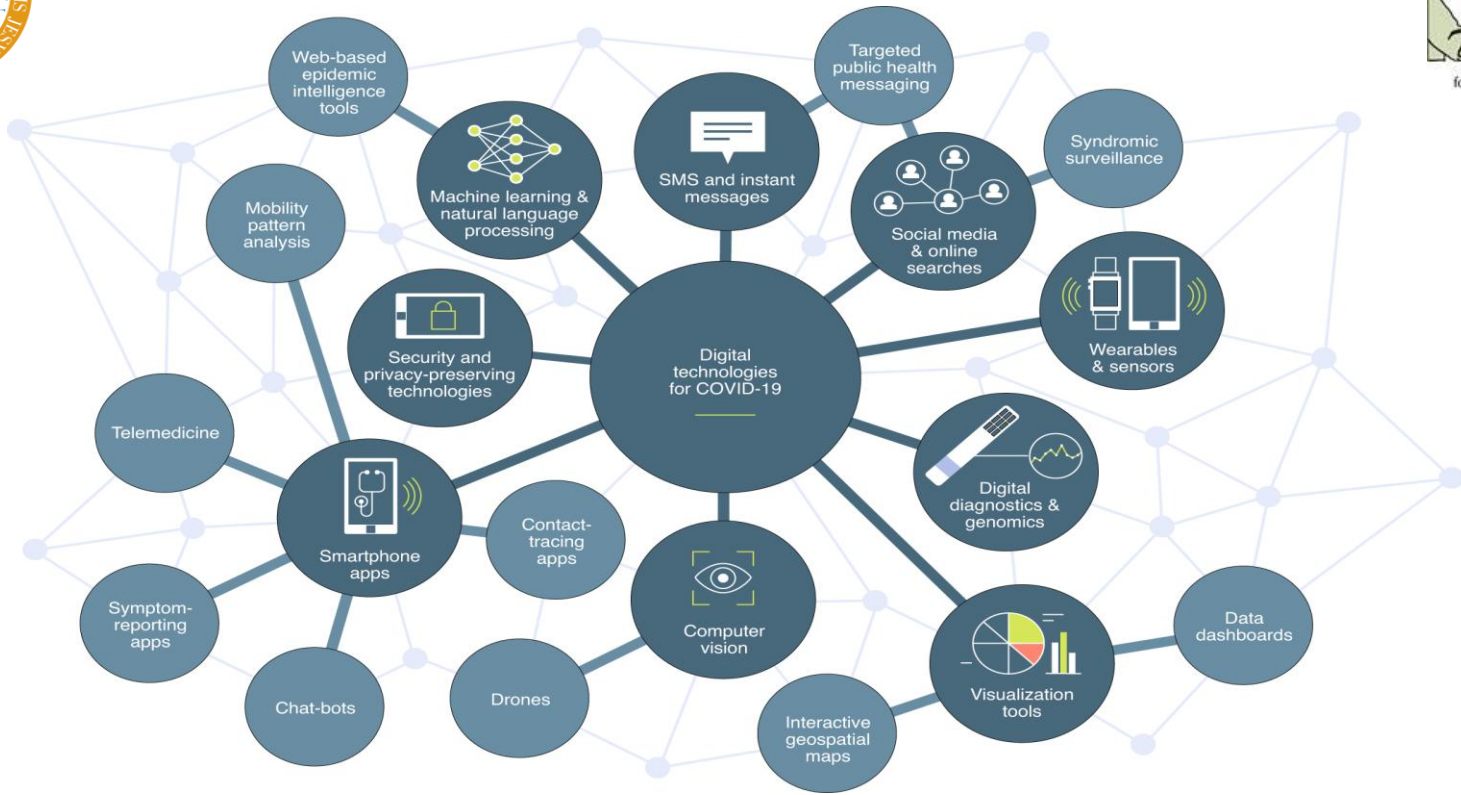
Disclosures: None



Budd et al, 2020

Digital tools for neurocognitive assessment and empowerment

Digital neuropsychology → focus on new approaches to measuring and monitoring cognitive functioning, considering both the potential and the limitations of technology (Germine et al, 2019)

Digital tools for neurocognitive assessment and empowerment

Several strengths →

- ✓ overcome spatial limitations and contextual restrictions
- ✓ greater accessibility
- ✓ richness of measures (parametric control of the stimulus)
- ✓ greater standardization (control over presentation and responses)
- ✓ possibility of integration with wearables (e.g., audiovisual and sensor technologies)
- ✓ cost reduction

Weak points →

- ✓ accessibility issues
- ✓ deprived relational dynamics
- ✓ user-acceptance
- ✓ client-acceptance
- ✓ modalities and infrastructures for distribution and maintenance

Digital tools for neurocognitive assessment and empowerment

The transition to digital neuropsychology cannot simply be a technology transfer

Being a revolution, it requires:

- ✓ a shift in **the way we conceptualize neuropsychological measurement**, which considers both the challenges and opportunities of digital assessment
- ✓ the development of more **sophisticated behavioral models** that emphasize the type of fine-grained data that can be easily acquired with digital devices (e.g. variability in reaction time), as well as considering possible confounding factors deriving from the digital setting (e.g. differences in the latency of input)

Digital tools for neurocognitive assessment and empowerment

Yet… how should neuropsychologists, psychometrists, researchers and healthcare professionals guide the changes introduced by digitalization for the development of new practices for research and clinical care?

Case history:

Validation of a remote sensory empowerment protocol for attentional regulation and proprioceptive-motor skills

Aim

Test the effects of a **training protocol** based on the use of centesimal **prismatic lenses**, evaluating their possible impact on proprioceptive-motor skills and cognitive performance

The project

A. Validation/proof-of-concept study

B. Clinical applied study

Phase 1:
Methods and procedure

Sample: 21 pp – $M_{età}$ = 23.29 $DS_{età}$ = 1.78
NB1: Randomized sssignement to EXT and AC
NB2: One participant diagnosed with LD (dyslexia)

Training protocol

EXP Training
Experimental intervention sensory enhancement training through centesimal prismatic lenses

AC Training
Active control – e.g., visual training and gymnastics

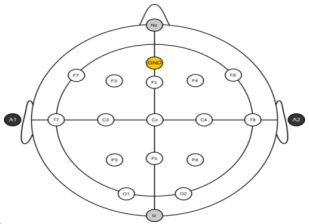
Total duration: 4 weeks

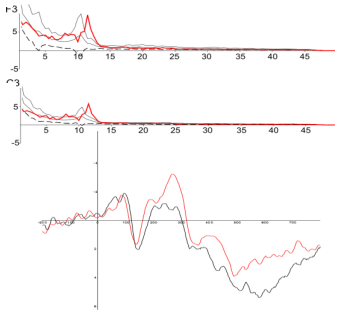
Daily sessions of practice

Type of activities during which to use the device: reading, study, use of other devices (TV, computer, smartphone ...), free time

Multi-level assessment

- Psychometric measures
- Proprioceptive and joint mobility skills
- Neuropsychological and cognitive measures
- EEG measures
- Autonomic markers
- Misure eye-tracking
- Walking analysis





Outcomes

↑ performance of attentional regulation, interference control and reading

↑ ERP markers (cognitive control and distribution of cognitive resources)

↓ autonomic markers of stress / peripheral activation in stressful tasks

Phase 2:
Methods and procedure

SAMPLE: 14 pp with LD – $M_{età}$ = 20.93 $DS_{età}$ = 3.15

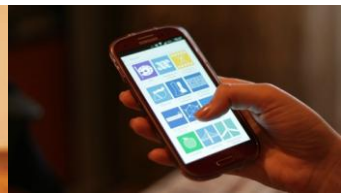
Training protocol

EXP Training
Experimental intervention sensory enhancement training through centesimal prismatic lenses

Total duration: 4 weeks

Daily sessions of practice

Type of activities during which to use the device: reading, study, use of other devices (TV, computer, smartphone ...), free time



Assessment and measurement tools - remote

- Psychometric measures
- Proprioceptive and joint mobility skills
- Neuropsychological and cognitive measures

Detail of multilevel remote assessment measures

Psychometric measures	- Anamnestic collection - Brief Pain Inventory - Brief Symptomps Inventory - Profile of Mood States - Body Perception Questionnaire - Vision distress questionnaire	- Online administration via synchronous videocall - Self-administration via web-based data collection platform (Psytoolkit)
Proprioceptive and movement skills	- Awareness of body weight distribution and standing posture - Awareness of walking performance - Single Leg Balance Test	- Online administration via synchronous videocall - Video recording of performance for subsequent offline analysis
Neuropsychological and cognitive measures	- Dual Task Test - Multiple Features Targets Cancellation Test - Stroop Task - Flanker task - Cueing task - Go/NoGo task - Visual Search Task - Reading task	-Online administration via synchronous videocall - Sharing of test documents and recording of performance for subsequent offline analysis - Self-administration via web-based data collection platform (Psytoolkit)

Case history:

Validation of a remote empowerment protocol mediated by wearable devices

Technology-Mediated Mindfulness Intervention

A. Promotion of wellbeing and emotional regulation in young adults – proof of concept

B. Enhancement and stress management in middle-aged expert managers exposed to work-related stressors

C. Wellbeing, cognitive enhancement, and promotion of active and healthy aging

D. Sport neuroscience, peak performance, and stress management in sports and competition

E. Driving behavior, sustained attention and stress management

Aim

Test a short-term neurocognitive enhancement protocol, delivered online and self-managed, mediated by technology and based on mindfulness on young adult users to enhance their emotion regulation, stress management and attention

Methods and procedure

SAMPLE: 56 healthy young adults – $M_{età}$ = 24.36 $DS_{età}$ = 9.63
NB1: Randomized sssignement to EXT and AC

Remote training

Target intervention

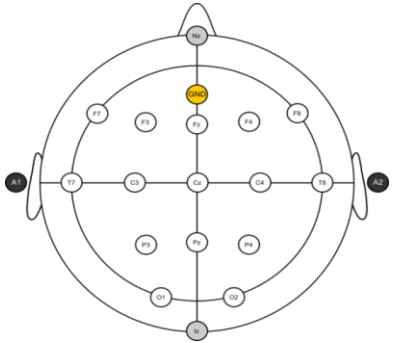
Wearable device + dedicated smartphone app, developed to support self-managed meditation practices and to help consolidate body and psychological awareness through regular practices based on mindfulness principles

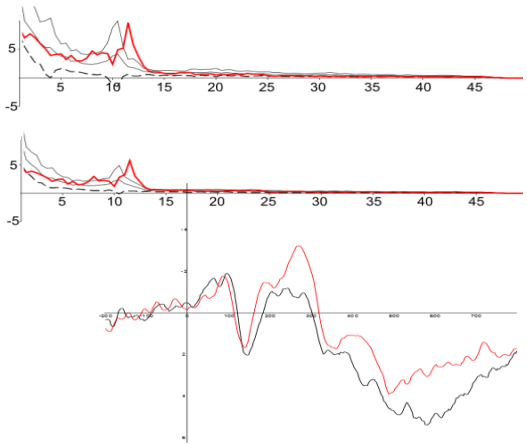
Active Control Intervention

Lack of support for mobile computing and wearable devices.
Expressive writing practices

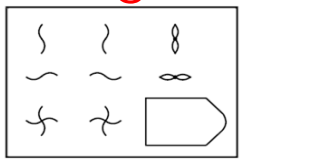
Daily session of practice, incremental duration

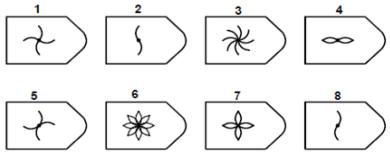
Multi-method assessment





- Psychometric measures
- EEG measures
- Neuropsychological measures





Outcomes

↓ perceived stress

mild ↑ cognitive performance

↑ adaptive and high-level emotion regulation strategies (reappraisal)

General conclusive notes

- Good procedural performance of tests delivered remotely
- Good level of engagement, good adherence to the tasks and training, and good level of commitment and participation in the various phases of the assessment procedures and empowerment protocols
- Positive impact in terms of session management - NB: both for operators and for participants → however, planning times increase
- No particular critical elements have been reported or detected in the online administration, although preliminary planning is necessary for the sharing of any materials to be used in assessment procedures and the preliminary verification of requirements for the online assessment (e.g. connection, video camera, PC, keyboard, setting controlled)
- But - NB - crucial requirement: availability and active involvement of the participant → relational dynamics and residual autonomy / basic skills

Final methodological and ethical remarks 1

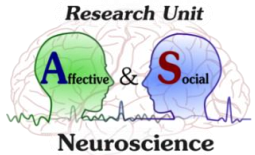
1. Transition from traditional to remote protocols for empowerment should not and cannot take the form of a mere transcription of classical solutions on the PC screen → renewed conceptualization of measurement + behavioural and neurofunctional models + new opportunities provided by wearables

2. Critical redefinition of roles and expectancies between users and operators → responsibility and agency attributed to the user + trust and commitment in shared management of training

Final methodological and ethical remarks 2

3. Effort towards theoretical, methodological, and technical training of operators → promoting a conscious use of media and technologies + privacy rights and data protection in digital exchanges + methodological awareness of potential biases (accessibility, usability, and performance of user's digital devices

4. Revision of protocol design to fully take advantage of the opportunities provided by digital media and wearable neurotechnologies →
   - reliability, validity, and personalization/user-centeredness of the training experience, but also
   - operator-centeredness (acceptance and quality of professionals experience)
   - device-centeredness (technical specifications, specific strengths – e.g. contexts-awareness and background monitoring in wearables



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