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

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Disclosures: None
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
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 – $M_{età} = 23.29$ $D\bar{S}_{età} = 1.78$

NB1: Randomized assignment 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
Valutazione preliminare ONLINE (t0)

Phase 2: Methods and procedure

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

Training

Post-training g assessment ONLINE (t1)
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**

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<tr>
<th>Psychometric measures</th>
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<tbody>
<tr>
<td>- Anamnestic collection</td>
<td>- Brief Pain Inventory</td>
<td>- Brief Symptoms Inventory</td>
<td>- Profile of Mood States</td>
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<th>Proprioceptive and movement skills</th>
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<tr>
<td>- Awareness of body weight distribution and standing posture</td>
<td>- Awareness of walking performance</td>
<td>- Single Leg Balance Test</td>
<td>- Online administration via synchronous videocall</td>
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<th>Neuropsychological and cognitive measures</th>
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<tr>
<td>- Dual Task Test</td>
<td>- Multiple Features Targets Cancellation Test</td>
<td>- Stroop Task</td>
<td>- Flanker task</td>
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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 – $M_{\text{età}} = 24.36$ $DS_{\text{età}} = 9.63$

NB1: Randomized assignment 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

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

mild ↑ cognitive performance
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
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 →
   o reliability, validity, and personalization/user-centeredness of the training experience, but also
   o operator-centeredness (acceptance and quality of professionals experience)
   o device-centeredness (technical specifications, specific strengths – e.g. contexts-awareness and background monitoring in wearables)