

Acronym: ExerG

Project title: ExerG: An innovative digital solution to individually improve physical and cognitive functions using an exergame (video game-based) training in an ecologically valid and safe setting for the geriatric population

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D2.1 Report on the literature review

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Partners involved (coordinator in bold): **HCIGG**

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¹ L = Legal agreement, O = Other, P = Plan, PR = Prototype, R = Report, U = User scenario

² PU = Public, PP = Restricted to other programme participants (including the Commission Services), RE = Restricted to a group specified by the consortium (including the Commission Services), CO = Confidential, only for members of the consortium (including the Commission Services)

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Informal Literature Review | Exergetic

Research question: What does the literature tell us about how to design exergames for older adults?

Speed, Pace, Movements

- no sudden movements (Kappen et al., 2019)
 - avoid speed and complexity (Nawaz et al., 2016)
 - give older adults time to understand and plan reaction (Brox et al., 2017)
 - +1 slower reaction times (Barenbrock et al., 2014)
 - +1 avoid extensive/sudden movements (Gerling et al., 2010)
- more complex movements than just "reaching" (Skjaret et al., 2016) but also limited range of movement (Brox et al., 2017)
- navigation controls should be designed with reduced dexterity and motor control in mind (Barg-Walkow et al., 2017; Gerling et al., 2010)
 - real-world objects/events to trigger everyday gestures (Skjaret et al., 2015; Zhang et al., 2019)
 - avoid small objects (Zhang et al., 2019)
- better efficacy when accompanied by strength and balance exercises outside of exergames (Kappen et al., 2019)
- monitoring physical characteristics to adapt gameplay (Kappen et al., 2019)
- introduce movements one at a time (Munoz et al., 2019; Harrington et al., 2015)
- personalized difficulty adjustment: "enabling usability for individuals with a range of motor, cognitive, and perceptual capabilities and limitations" (Barg-Walkow et al., 2017)
 - +1 (Munoz et al., 2019)
 - adaptive +1 (Barenbrock et al., 2014)
 - adaptive speed +1 (Skjaret et al., 2015)
 - +1 adaptive motor skill levels (Gerling et al., 2010)
 - +1 adapt difficulty, speed, input sensitivity (Gerling et al., 2010)
 - +1 adapt speed & distance (Eisapour et al., 2018)
 - keep in mind that increased difficulty can impact movement characteristics (Skjaret-Maroni et al., 2016)
- include cognitively demanding tasks (Munoz et al., 2019)
 - appropriate cognitive challenges (Gerling et al., 2010)
- movements to develop body awareness (Nawaz et al., 2016)
- less intensity of movement, but more effective movements (Velazquez et al., 2013)

Game Mechanics

- adaptable content (Kappen et al., 2019)
- easily identifiable goals and objects (Eisapour et al., 2018)
- repetition of game and level to showcase progress (Skjaret-Maroni et al., 2016)

Social Interaction

- social exergaming is important (Kappen et al., 2019)
 - competitive scoreboards and chat functions for social activity to
 - improve adherence (Skjaret et al., 2016)
 - social interaction (Nawaz et al., 2016)
 - competition among players (Nawaz et al., 2016)
 - play in groups (Nawaz et al., 2016)
- social/multiplayer options, both comp + collab (Munoz et al., 2019)
 - +1 social activities (Gerling et al., 2010)
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- willingness to use is contagious (i.e., use by peers+friends increases others' willingness to use) (Chen et al., 2018)
- social interaction with other players, therapists, avatars, animals, other game elements to benefit mental health (Yen and Chiu, 2021)

Supervision, Guidance, Safety

- either person or automatic recognition of falling (Barenbrock et al., 2014)
- guidance/tips for discovering game mechanics (Velazquez et al., 2013)
- show gesture control instructions on screen "to serve as guidance and reinforcement" (Harrington et al., 2015)
- additional equipment not required - walking aid if necessary is enough (Skjaret et al., 2016)

Narrative

- 3d avatars and game narratives helped (Kappen et al., 2019)
 - topics to share with grandchildren (Nawaz et al., 2016)
- emphasize a narrative (Munoz et al., 2019)
- draw from enjoyment of familiar activities (Zhang et al., 2019; Munoz et al., 2019; Eisapour et al., 2018), e.g., from the players' past (Barenbrock et al., 2014) real-world objects/events to trigger everyday gestures (Skjaret et al., 2015)
- meaningful tasks (Gerling et al., 2010; Zhang et al., 2019) that evoke positive emotions (Zhang et al., 2019)

Feedback

- immediate feedback (audio + visuals) (Nawaz et al., 2016)
 - emphasis on positive feedback (Nawaz et al., 2016)
 - help with discovering game mechanics (Velazquez et al., 2013)
 - bright colours, good contrast (Brox et al., 2017)
 - avoid small details and small fonts, as little text as possible (Brox et al., 2017)
 - include audible feedback (Brox et al., 2017)
 - * "volume should be the same for all sounds" (assume this doesn't mean for background music vs. SFX...) (Brox et al., 2017)
 - action feedback (Harrington et al., 2015)
 - visual feedback +1 (Skjaret et al., 2015)
 - visual + auditory feedback +1 (Zhang et al., 2019)
- personalization to goals and performance (Skjaret et al., 2016)
 - clearly visualized goals and progression (Skjaret et al., 2016)
 - challenges (Nawaz et al., 2016)
 - avoid personal data on screen (e.g., BMI, center of gravity) (Nawaz et al., 2016)
 - frequent feedback (Munoz et al., 2019)
 - permanent feedback (scores shouldn't appear and disappear) (Barenbrock et al., 2014)
 - in-game help tutorials (Barg-Walkow et al., 2017)
 - motivational feedback (Gerling et al., 2010)

User Interface

- native language for motivation (maintain interactional experience) (Nawaz et al., 2016)
- generally slower pace in instructions to allow older adults time to engage with the game (Velazquez et al., 2013)
 - clear instructions, repetition (Brox et al., 2017)
 - gameplay OR information, not at the same time (one point of focus) (Brox et al., 2017)
 - repetition (Harrington et al., 2015)
- reduced complexity of instructions (Barg-Walkow et al., 2017) and visuals/ interfaces (Harrington et al., 2015) and "steps" (Gerling et al., 2010)
- inclusive design principles (Barg-Walkow et al., 2017)
 - accessible interfaces, visually adjustable (fonts + colours) (Gerling et al., 2010)
 - reduced attention span with some cognitive impairments (Gerling et al., 2010)
- aim for perceived playfulness and usefulness (Chen et al., 2018)
- visually not too overwhelming (e.g., Mario Kart is too much) (Barenbrock et al., 2014)
- allow interaction/navigation while sitting or standing (Gerling et al., 2010)

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