

# QT-ROBOT: A THERAPIST'S LITTLE HELPER

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## Background

There is thought to be almost **1 million** individuals living with Dementia in the UK alone (2020).<sup>1</sup> An intervention that helps to combat this is **music therapy**. This is a non-pharmacological intervention utilising music-based activities to engage participants while stimulating / exercising areas of their brain. This is done with the intention of maintaining and potentially **even increasing cognitive functions**, such as memory, executive functions, attention, etc. while also serving to **reduce symptoms of depression and loneliness**.<sup>2</sup>

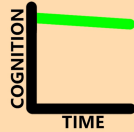
## Aim's and Hypothesis

This research aims explore these aspects:

1. If a humanoid robot (QT-Robot of LuxAI) can successfully **facilitate cognitive training** as part of a cognitive rehabilitation intervention.
2. How effectively a small humanoid robot can **contribute to music therapy**.

We hypothesise that:

- A. This robot will be successful in providing **effective cognitive training** to older individuals with mild cognitive impairment.
- B. Robot led interventions will be able to **maintain benefits** obtained from music therapy sessions.



Left: Example progression of dementia

Right: Example progress of dementia with robot + MT intervention

## QT-Robot

At the center of this research, QT is the **host and facilitator** of the cognitive training.

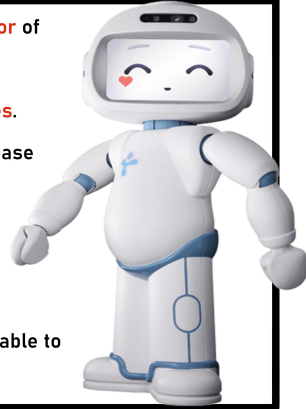
QT-Robot is a small humanoid robot which is capable of expressing emotion using **facial expressions and gestures**.

Armed with **10+ musical themed cognitive games** to increase enjoyment and range of cognitive domains exercised.

QT will serve as an **aide to music therapists**, enabling them to further the reach of music therapy.

It is intended to be an assistant and not a replacement to music therapists.

This robot is a socially assistive humanoid, meaning it is able to recognise faces, hold conversations and **provide care**.



## Cognitive games



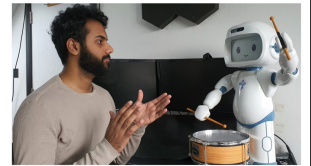
There is evidence that supports cognitive games being an effective means of increasing / **maintaining cognitive function**, as well as evidence that suggests a social robot can be **sufficient in hosting these games**.<sup>3,4</sup>

These are games that **target specific cognitive functions**, with the intention of stimulating them. Below are 4 games that QT robot plays.



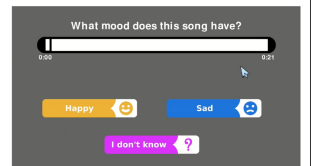
## Clap to the beat

QT drums to a backing track encouraging the player to clap along. This game targets **attention and motor-functions**. We adapt the game based on user ability by selecting tracks with higher BPM, that have more ambiguous beats.



## Guess the mood

After hearing a snippet of a select (personalised based on user tastes) song, the user must input what mood they feel that this song is. This game targets the players **emotion-recognition** and is an opportunity for them to listen to **music they enjoy**. Based on the user's ability to recognise implied emotion in music, we increase the challenge by changing the songs to ones with more ambiguity in their feeling.



## Fix the song

The player is made to listen to a longer snippet of a song (30 - 60 seconds). The snippet they hear is then divide into sections, called song segments. Their task is then to restore the song by combining these individual segments using the graphical user interface. Songs are broken into 2 - 4 segments depending on user ability, while music is all music that they are already familiar with. This game aims to exercise **short-term memory and executive functioning**.



## Simon says clap

Similar to the Clap to the beat: QT hits his drum to the beat of music. The user is prompted to clap along, except in this game, QT will suddenly stop drumming. The user is told to only clap when QT is clapping. This is intended to target **attention, motor functions as well as executive functioning**.



## What's next ?

Following 2 design cycles, we will continue to **pilot the games** and the interaction with more individuals who fit our age demographic (65+). This ensures we stay on the right tracks and that the games are applicable to this group.

**Development must continue!** Many features and games that QT robot needs to learn are yet to be made. Such as a web interface, user profiles, engagement analysis and many more.

For more information, please scan the QR code shown right to visit the MCCLab website (<https://mcclabmdx.com/musicare/>).



1. Alzheimer's Society. 2022. Alzheimer's Society's view on demography. [online] Available at: <[2. Bamt.org. 2022. British Association for Music Therapy : What is Music Therapy?. \[online\] Available at: <\[3. Jaeggi, S., Buschkuhl, M., Jonides, J. and Shah, P., 2011. Short- and long-term benefits of cognitive training. Proceedings of the National Academy of Sciences, 108\\(25\\), pp.10081-10086.\]\(https://www.bamt.org/music-therapy/what-is-music-therapy#:~:text=Because%20musical%20participation%20and%20response,therapists%20can%20be%20life%20changing.> \[Accessed 12 May 2022\].</a></p></div><div data-bbox=\)](https://www.alzheimers.org.uk/about-us/policy-and-influencing/what-we-think/demography#:~:text=Research%20conducted%20shows%20that%2C%20in,the%20current%20rate%20of%20prevalence.> [Accessed 12 May 2022].</a></p></div><div data-bbox=)

4. Park, E., Jung, A. and Lee, K., 2021. The Humanoid Robot Sit-Bot in a Cognitive Training Program for Community-Dwelling Elderly People with Mild Cognitive Impairment during the COVID-19 Pandemic: A Randomized Controlled Trial. International Journal of Environmental Research and Public Health, 18(15), p.8198.