

# EXPLORING THE NEUROPLASTICITY OF MUSIC TO RE-ESTABLISH SYNCHRONIZED BEHAVIOR AND COMMUNICATION PATTERNS BETWEEN INDIVIDUALS WITH DEMENTIA AND THEIR CAREGIVERS

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## Background

Emerging evidence suggests that music-based experiences offer a range of potential benefits for individuals with Alzheimer's disease and persons with dementia (PWD), including improvements in motor synchronicity, emotional regulation, and a reduction in motor impairment. Research has further demonstrated that familiar music listening activates neural networks in regions of the brain associated with emotional processing, including the frontal and prefrontal cortex, suggesting that music-based experiences can compensate for deficits in emotional and cognitive processing. (Leggieri, et al., 2018) Evidence illustrates that music-based experiences have a meaningful impact on AD patients and PWD and is a promising non-pharmacological treatment option.

## Study Aims

Ascertain the impact of music-based experiences on the brain wave activity of people with AD

- Aim 1:** Investigate the impact of music-based experiences on brain wave activity of individuals with dementia and examine its association with behavioral and interpersonal functioning using EEG technology to gain insight into the underlying neural mechanisms.

Ascertain the impact of music-based experiences on the brain wave activity of age-matched neurotypical peers.

- Aim 2:** Investigate the impact of music-based experiences on brain wave activity of age-matched neurotypical peers (caregivers) and examine its association with behavioral and interpersonal functioning using EEG technology to gain insight into the underlying neural mechanisms.

## Hypothesis

Observing the effect of specific interventions, such as improvisational music making, recreative music experiences, and receptive music listening, using EEG technology will uncover the neural mechanisms that occur during music-based experiences.

## Methods

**Participants:** Participants were recruited in pairs of a person with dementia and their similarly aged caregiver from the New River Valley region of Virginia. All participants signed informed consent forms before participating in the study and completed a debrief interview after they completed all the therapy sessions. There were three pairs originally recruited, but one pair dropped out of the study early on, so we primarily analyzed the data from the two pairs that completed the study.

## Methods Cont.

**Therapy procedure:** 30-minute music therapy sessions occurred weekly for 12 weeks. Before each session, participants were greeted by research assistants, donned EEG caps, and answered a questionnaire about medication, caffeine use, and any significant changes in their health/illness. Each session started with a welcome song followed by call and response, synchronized, and improvised drumming, and another song. The therapist was free to adjust sessions to fit the participants' needs if something came up, but the therapy sessions retained the same general structure and activities. Therapy sessions were conducted in the Cube of the Moss Arts Center at Virginia Tech, a room with minimal furniture and plain black walls and floor. Participants sat in chairs set up in a circle and were given drums and egg shakers to use in the therapy session; they were also invited to sing during the welcome and wrap-up songs.

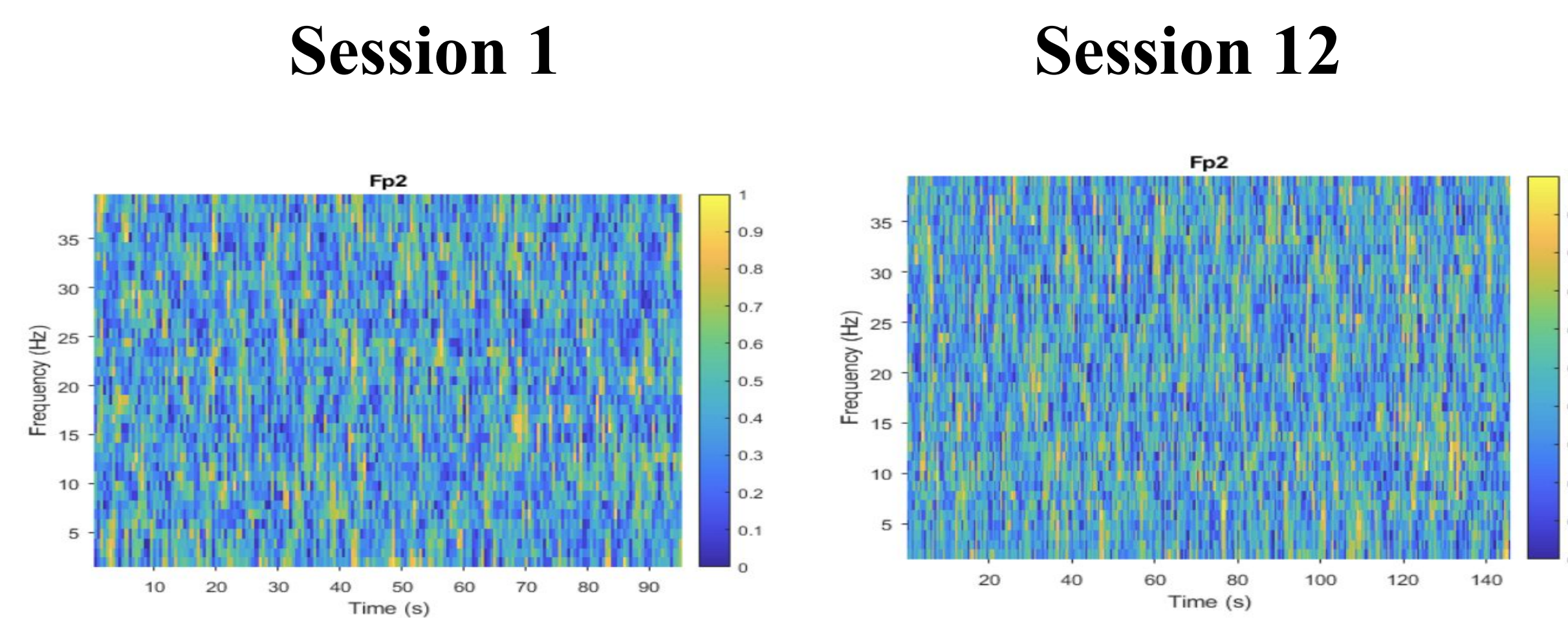
**EEG:** Cognionics wireless, dry EEG caps were used, and data were collected from frontal, central, temporal, and occipital brain regions.

**Movement coding:** Video and audio was recorded of each session with a 360 camera in the center of the circle; each participant was clearly in view. Each session, the movements of each participant within 20-second time segments were coded by at least two people.

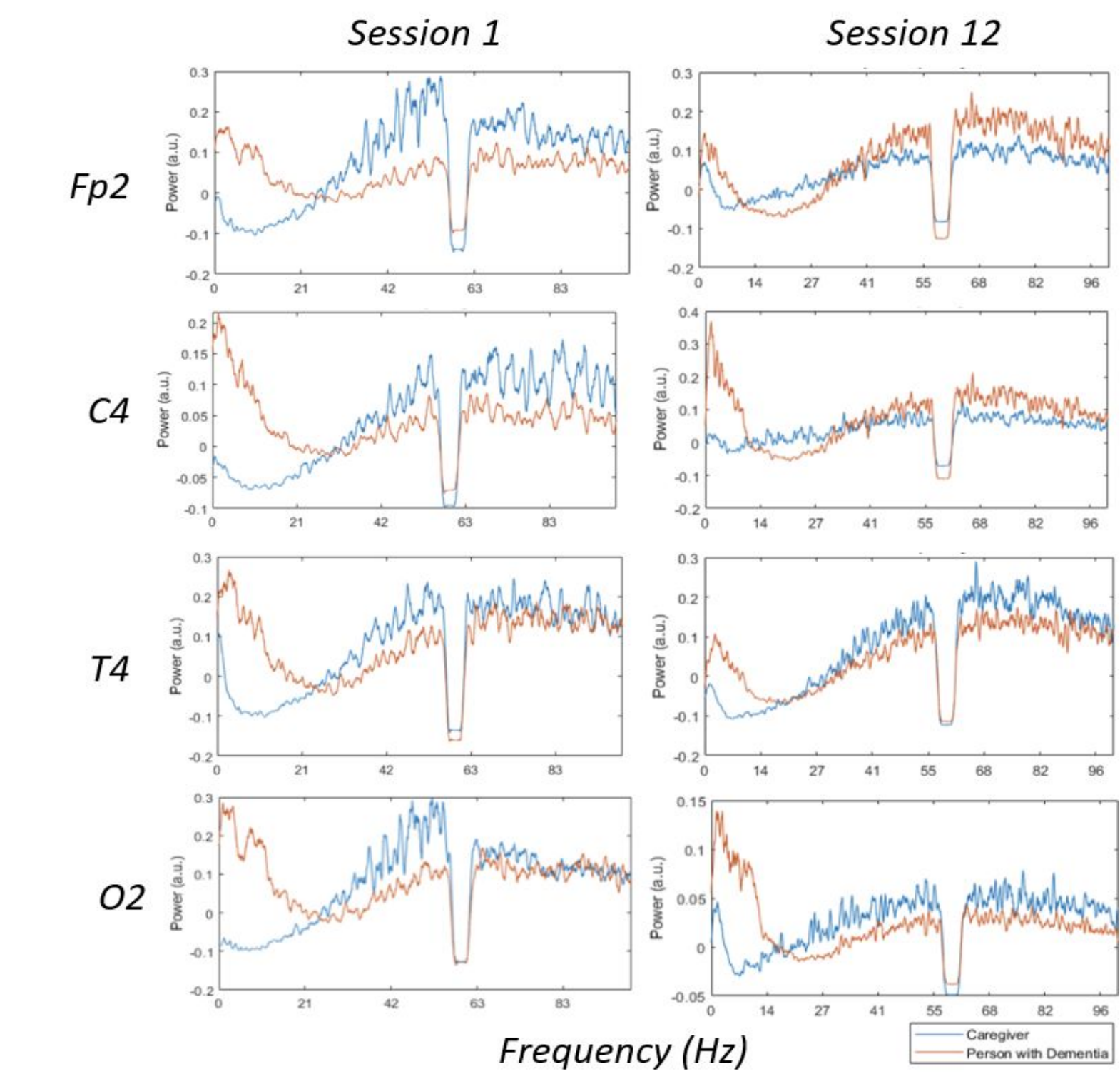
	no target movement	toward member	toward part	toward facilitator	toward other member	toward instrument	retreat from another person	or manipulate	out of time
5) Head/Gaze * must provide value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Torso/Lean * must provide value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Arms/Hands * must provide value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8) Leg/Foot * must provide value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Additional notes: SF/MR Nodding with speech/agreement Gaze into the abyss	<input type="text"/>								

**Figure 1:** RedCap form accounted for movement analysis recorded by body part (head/gaze, arms/hands, torso/lean, feet) and direction (interacting with: care partner, therapist, other participant, instrument).

## Preliminary Results



**Figure 2.** Cohereograms depict the power across a spectrum of frequencies (y-axis) during synchronization drumming sessions 1 and 12 for frontal electrodes (Fp2) located on the brain's right hemisphere. Initial results point that power coherence between caregiver and individual with dementia rises as music therapy sessions progress, as evidenced by the increase in yellow density from the first to the twelfth session.



**Figure 3.** The power spectral density plots for electrodes on the right side of the brain, specifically the frontal (Fp2), central (C4), temporal (T4), and occipital (O2) regions, were analyzed during synchronized drumming sessions 1 and 12. The preliminary data indicates that the power across a range of frequencies becomes balanced between individuals with dementia (orange) and their caregivers (blue) throughout the course of the music therapy intervention.

## Discussion

Impact of results:

- Implications to these results can allow caregivers and healthcare professionals to apply music therapy to improve PWD's quality of life.

Further steps for research/where the lab is headed:

- Continuation of research in NRV area: Blacksburg (Virginia Tech) & Carilion/Radford.
- Possible outreach to nursing home implantation.

Ethical consideration with a participant dropping

- Research assistants are trained to understand when participants are undergoing a stressful change. Therefore, if any were observed they were addressed with the right precautions. All participants have the ability to drop before, during, and after. If any participant was undergoing stress during the capping process, then capping was stopped and the option to leave was granted.

## Reference & Collaborators

