**What is this study about?**

The first study to examine how LSD and music work together to alter human consciousness and brain activity. It is one component of a larger study using state-of-the-art brain imaging to give first insight into what happens in the brain to produce LSD’s psychedelic (and potentially therapeutic) effects.

**Why did we do this study?**

- Music is an effective tool for evoking and studying emotions.
- Psychedelics were used in psychotherapy in the 1950s and 60s. It was believed (but not scientifically evaluated) that music was an important component of this therapy.
- Our previous findings showed that LSD enhances the emotional response to music, creating a deeper and stronger emotional experience.
- **In this study, we wanted to know:** What underlies this difference? How does music influence the effect that LSD has on the brain?

**What did we do?**

- We gave 12 people either LSD (75µg intravenous) or placebo (saline) on 2 separate days.
- On each day, they then underwent brain imaging and completed questionnaires. Brain imaging (fMRI) measured activity during rest and while listening to music.
- We focused the analyses on a specific region of the brain: the parahippocampal cortex (PHC), which is involved in emotion, memory, and ego/self functions, and has been linked to the response to psychedelics.
- We analysed the data in two ways:
  - **Seed-based analysis** = a method of measuring all the functional connections a particular brain region has (in our case parahippocampal cortex).
  - **Dynamic Causal Modelling** = a method to determine the direction of information flow between connected regions.

**What did we find?**

1. **INCREASED connectivity between the PHC and the rest of the brain.**

   Music on LSD (vs. music on placebo) increased connectivity of the PHC (red) with several other regions (yellow/orange), especially the visual cortex.

2. **INCREASED INFORMATION FLOW from the PHC to visual cortex.**

   - The direction of increased connectivity was found to be from PHC to the visual cortex.
   - This effect correlated with self-reports of ‘eyes-closed visions,’ including complex images (scenes, etc.) and visions of one’s past.
   - Together, the findings suggest that music and LSD interact to increase vivid mental imagery of an autobiographical nature.

**Why do we make of this?**

- PHC is highly connected with the Default Mode Network (DMN), which exerts top-down control over the PHC. Psychedelics decrease this DMN control, resulting in altered consciousness.
- LSD and music interact to lift the usual top-down control that the DMN holds over the PHC, allowing the PHC to interact more freely with the visual system.
- The input of memories to the visual system – a ‘flip’ in the normal direction of information flow – may underlie the visions reported by participants.

**Why is it important?**

- Progresses our understanding of brain function by clarifying the neural circuits involved in visions; and
- Develops a rationale for LSD-assisted psychotherapy by explaining how music – which acts to liberate emotional memories – interacts with LSD to help evoke personal memories and enhance mental imagery.