

Background

What is hypnagogia?

Hypnagogia is a biological state experienced directly at the onset of sleep. Although detailed research into hypnagogia is relatively new, it is hypothesized that very creative dreams are experienced during this sleep onset.

How has hypnagogia been utilized?

Great minds like Newton, Edison, Einstein, Beethoven, Dalí, and others are reported to have intentionally monitored this state by holding heavy objects as they began to sleep. As they entered hypnagogia, the noise made by dropping the object would wake them, allowing them to record their dreams.

Our Task:

By measuring grip pressure and heart rate, the DreamKeep system measures when the onset of sleep occurs, prompts the user to dream about a topic with a pre-recorded message, and wakes the user to record their dreams. With this device, more detailed research can be done into the sleep state hypnagogia itself, as well as taking advantage of the creative thoughts and ideas it produces.

Inspiration and Purpose



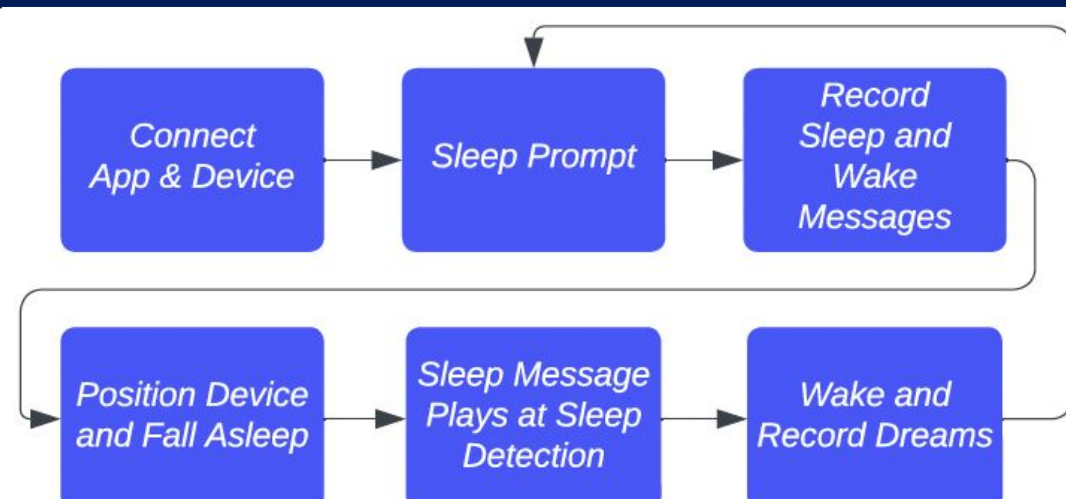
Adam Haar Horowitz and his team from the MIT Media Lab have made their own path into researching hypnagogia and its advantages.^[1] Their 'Sleep Glove' (left) pairs with a Jibo Robot to track the transition in sleep state, ultimately prompting and recording creative dreams. Dr. Paul Seli, a Psychology professor at Duke University, has aspirations of increasing

the scope of research to learn more about the state and its benefits.

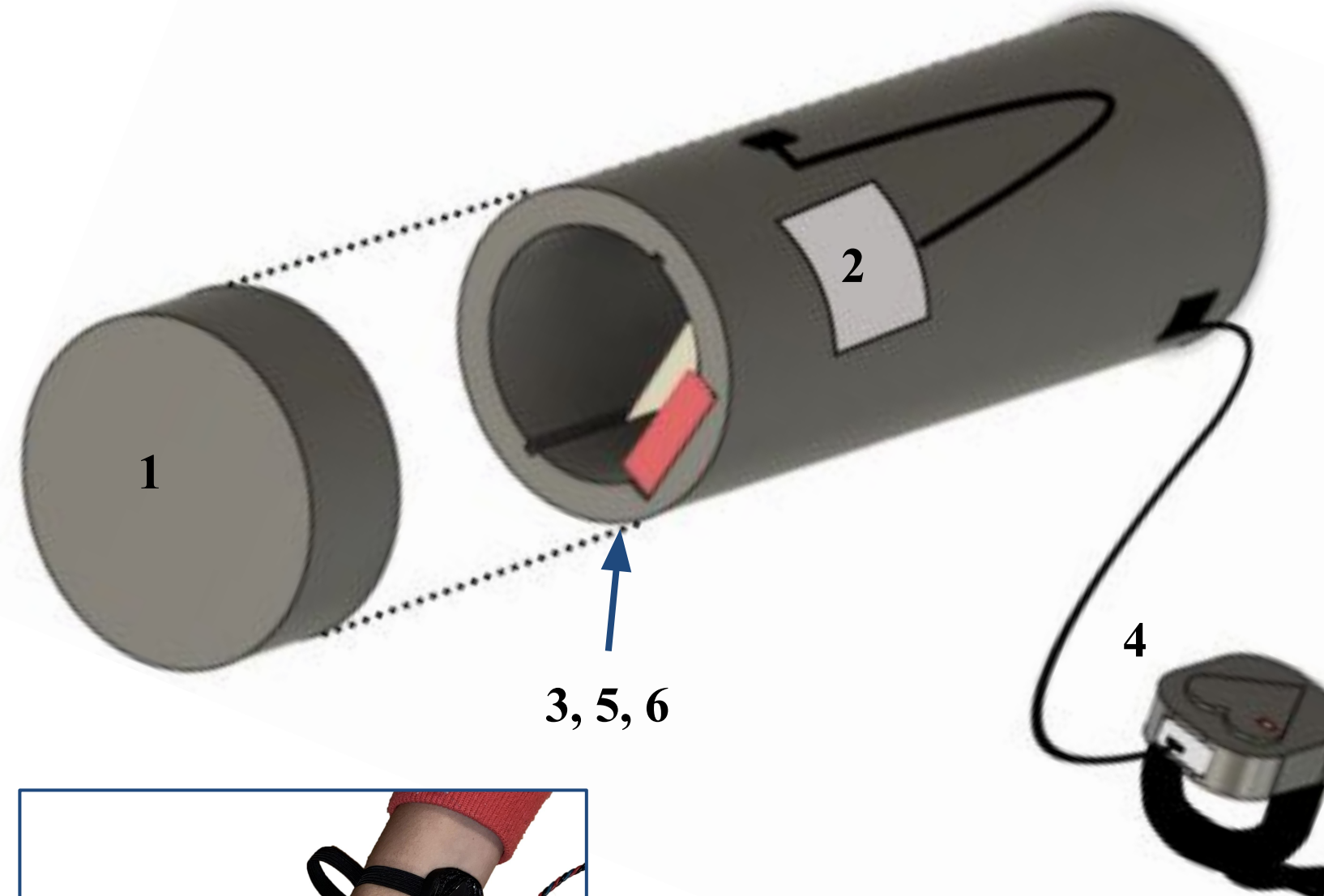
Goals

- 1) Unique solution from existing Sleep Glove design
- 2) Accurately detect hypnagogia
- 3) Significant cost reduction (< \$100)
- 4) Friendly for non-tech users
- 5) Wireless connection between device and app
- 6) Comfortable to sleep with (ex. limit exposed wiring)
- 7) Record and save dreams

App Flow



Components and Design



In-person positioning of DreamKeep

1. Device Housing

The housing is 3D printed using PLA on Ultimaker S3 printers. The entire device is wrapped in grip tape to secure and hide sensors and improve aesthetics.

2. Pressure Sensor

Users are instructed to grip the cylinder as they get ready to sleep. As they enter hypnagogia and lose the ability to grip with the same firmness, the thin film pressure sensor adhered to the surface of the cylinder detects small changes in pressure. This serves as the first of three triggers for sleep onset.

3. Core Electronics

By throwing the switch, a 9V battery provides power to the ESP32 board that is capable of sending a bluetooth signal to the DreamKeep app.

4. Pulse Sensor Wristband

The DFRobot pulse sensor paired with the appropriate code can accurately display and record the user's heart rate in beats per minute (BPM). When the user begins sleep, a baseline BPM is collected. When the user enters hypnagogia, the decrease in heart rate serves as the second trigger for sleep onset.

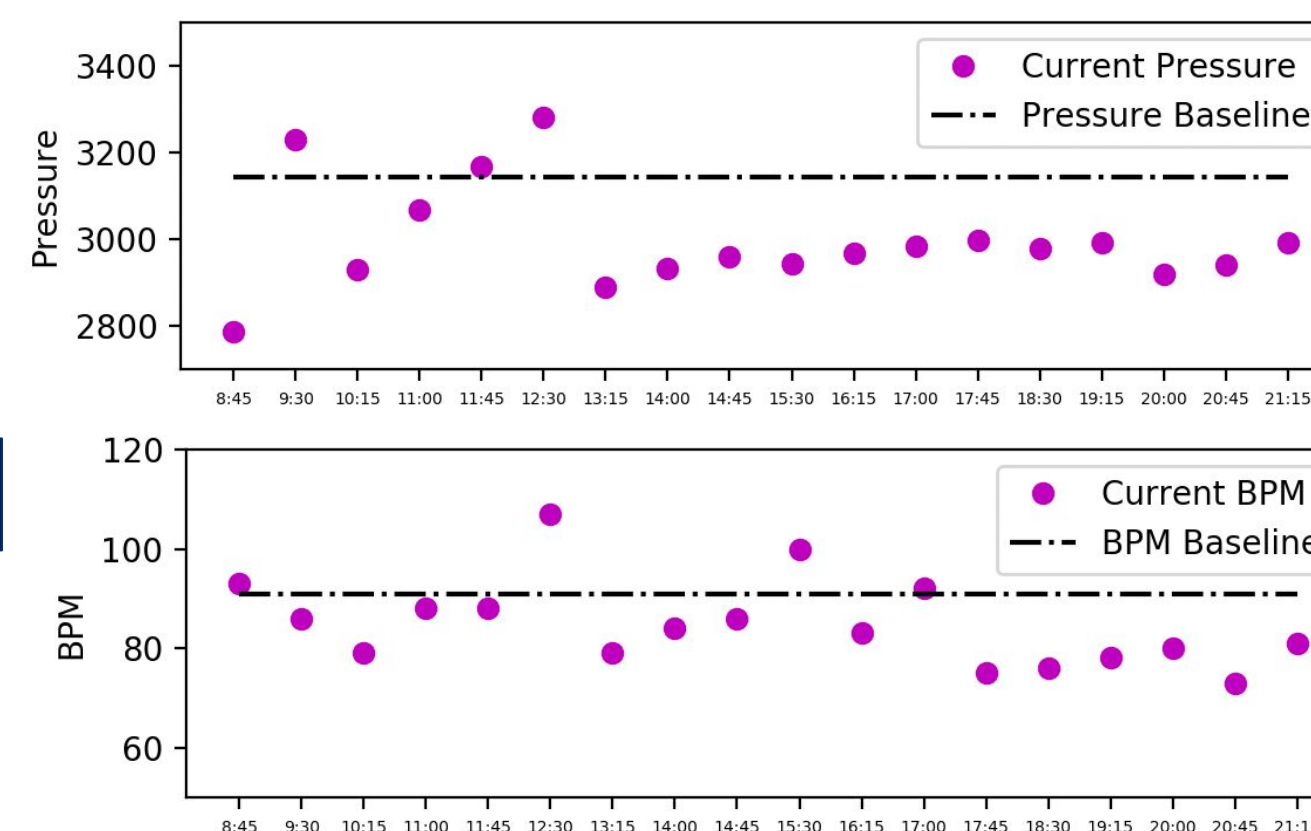
5. Accelerometer

A triple-axis accelerometer is the third trigger for sleep onset. If the user drops the device, a fall is detected, overriding the pulse and pressure sensors.

6. Breadboard

The breadboard slides inside the cylinder and houses the electrical circuit with an ESP32 microcontroller and the accelerometer.

Data Collected



The readings above correspond to a trial of the DreamKeep device. After 21 minutes and 15 seconds, both pressure and BPM readings had been under their baseline for 5 intervals of 0:45 seconds each, indicating sleep onset.

Conclusion

After design, production, and testing, DreamKeep accurately detects hypnagogia, allowing the user to access their creative dreams. The cylindrical design and corresponding app accomplishes the goals set forth, is comfortable to sleep with, and costs \$70. This device equips Dr. Seli and other researchers with an inexpensive device to conduct further, more expansive research into the hypnagogic state. It can also be used by the public to record their most creative dreams..

Acknowledgments

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[1] Rosello, O. (n.d.). Dormio: Interfacing with Dreams. Retrieved from Mit Media Lab