

A Research Brief:

Two Case Studies of EEG monitored Brain States Related to Sonic Entrainment-based Sleep Music.

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Two subjects were monitored in this pilot study of the effects of a combination of bed-based vibro-tactile and earphone delivered tympanic perception on EEG patterns. Subject one was a 60 year old female with a history of periodic sleep disturbances related to stress and menopause. Subject two was a 50 year old male with a serious sleep disorder history diagnosed with Restless Leg Syndrome and currently on medication. For subject two the experiment was carried out when the medication was no longer in effect. Subjects reclined on a bed fitted with a SleepMachine™ system provided by Renaissance Sound LLC. Music from the Somerset, Sonic Aid recording “Music to Promote Sleep” track two was played on an Apple Computer with a NAD C740 amplifier driving a single I BEAM VT-300 vibro-tactile transducer and AKG K240 Studio earphones. EEG data was gathered on a single channel at C3 and filtered for delta, theta, and alpha levels. Both subjects were tested in the afternoon in a room with windows facing west with semi-opaque curtains drawn. For purposes of alpha readings subjects began the experiment with eyes closed. EEG amplitude averages were recorded in two minute segments beginning with two periods with no music. At the start of the third segment the recording was started. Subjects lay on their backs with head on a thin pillow.

Subject one prefers to sleep face down and found the position on her back somewhat uncomfortable. The EEG level of delta during silence was predictably low at 7.7 and 7.6 and stayed at those levels for about 10 minutes but began to rise in period 8. Theta and alpha both rose as well. This was followed in period 9 (12 minutes of music) with a significant rise in delta (28%) and an attendant drop in theta and alpha. The subject was not asleep but clearly showed evidence of a significant rise in delta and the readiness for sleep.

Table One. Subject One Data

Time period (each period 2 minutes)	Delta 1.0-4.0 hz Period average amplitude	Theta 4.0-7.0 hz Period average amplitude	Alpha 8 – 11hz Period average amplitude
Silence baseline p1	7.7	9.1	14.1
Silence baseline p2	7.6	8.1	11.6
Track 2 music period 8	7.9	10.2	15.2
Track 2 music period 9	9.9	9.6	12.5

Subject two began showing signs of increased delta amplitude almost immediately after the music was started with a rise in delta amplitude from 9.5 to 11.9 and two minutes later reached an average delta amplitude of 17.0 indicating very strong sleep tendency. An examination of the actual moment by moment EEG run reveals a rapid rise in the delta zone to a high of 26 and then a fairly sudden drop-off with an attendant rapid rise in alpha. The subject reported that as he felt himself falling asleep he had a bout of restless leg syndrome with spasms in the legs. This is reminiscent of epileptic seizures triggered by entrainment-induced rapid state change.

Table Two. Subject Two Data:

Time period (each period 2 minutes)	Delta 1.0-4.0 hz Period average amplitude	Theta 4.0-7.0 hz Period average amplitude	Alpha 8 – 11hz Period average amplitude
Silence baseline p 1	9.4	12.2	15.4
Silence baseline p2	9.5	11.4	13.4
Track 2 music period 3	11.9	10.2	9.4
Track 2 music period 4	17.0	13.6	11.0

Although a rise in delta could be a naturally occurring phenomenon when a person lies down in bed at 4:00 pm in a bright room, it is even less probable with electrodes on each ear and on the head with a researcher standing by. Consequently, the evidence of this observed increase in delta in the given time periods provide a strong argument for the influence of the vibro-tactile and tympanic stimulus when specifically designed music to induce sleep was exposed to the test subjects.