

## PIXIE DUST TECHNOLOGIES, INC.

Revolutionizing a preventive care of Alzheimer's disease via TV audio system by applying its proprietary wave control technology

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Founded in 2017  
Co-Founder & CEO: OCHIAI Yoichi, PhD  
No. of employees: 89  
Type of Ownership: Public  
Primary stock exchange: NASDAQ PXDT

**January 2024:** Invented a new audio method with gamma wave sound to prevent or even improve Alzheimer's disease. Venture Valuation (VV) interviewed, TSUJI Mitsutaka, General Manager, and NAGATANI Yoshiki, PhD, Senior Engineer.



*Pixie Dust Technologies, Inc.*

**VV:** Your company is an expert in wave control technology and teaming up with various businesses and academia. The gamma wave modulation technology is one of 40 projects that you are conducting research and development on.

**Tsuji & Nagatani:** The gamma wave modulation technology has been developed in collaboration with a pharmaceutical company.

Gamma waves at a frequency of 30 to 100 Hz (hertz: cycle per second) have been shown in numerous studies to be closely related to the human brain's cognitive function. Also suggested is that Alzheimer's patients show a weakening of their gamma-frequency oscillations. The sound stimuli treatment, specifically at 40 Hz, has evidenced in preclinical studies that levels of beta-amyloid plaques and phosphorylated tau protein, another Alzheimer's-related pathogenic marker, have been reduced. Also, the activity of microglia, debris-clearing immune cells, has been stimulated.

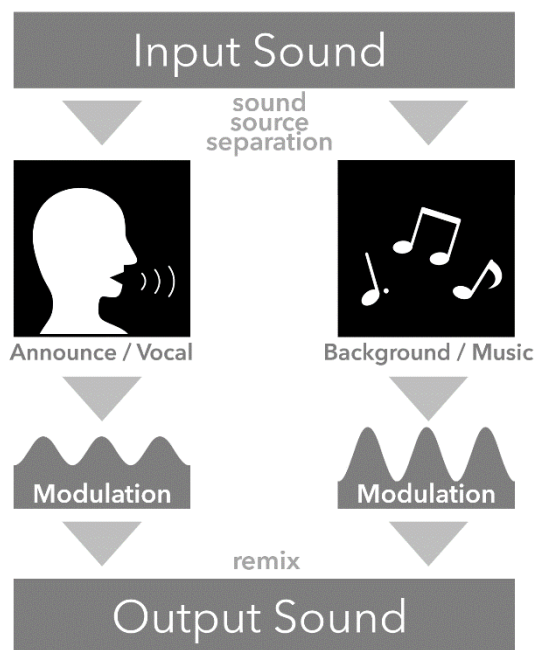
We decided to make these positive effects of gamma wave sound available, recognizing the benefits it brings to daily life care.

**VV:** 40 Hz gamma wave pulses are known to be an unpleasant mechanical noise resembling a buzzer, which may be tolerable for clinical studies or intense treatment but not for daily life use. You digitally separated the vocal sound and

background sound like music so that one can watch and listen to TV without noticing the difference.

**Nagatani:** We developed an acoustic stimulation speaker device integrated with gamma wave modulation technology that processes and modulates regular TV audio with a 40 Hz amplitude modulation algorithm. The device was initially conceived to serve elderly users but is useful for anybody who is interested in gamma wave modulation technology.

The illustration below<sup>1</sup> shows a simplified process for separating voice from background sound, each amplitude modulation, adjustment, mixing, comprehensive adjustment and tapering.



**VV:** There is a U.S. startup company co-founded by a scientist who conducted the first preclinical study to prove the positive effects of gamma waves on neurodegenerative disease. That company is developing a headset-style medical device for Alzheimer’s that is currently in clinical studies. How do you differentiate your technology from theirs?

**Nagatani:** We are focusing on sound stimuli and daily life preventive care for Alzheimer’s disease whereas the American company is developing a medical device with both light and sound stimuli for patients living with neurodegenerative diseases including Alzheimer’s. We think our product and theirs will complement each other to improve the quality of life for those enduring Alzheimer’s disease.

<sup>1</sup> Y. Nagatani et al., “Phase lock of gamma wave by aurally presenting tones amplitude-modulated at 40 Hz,” Neuroscience 2023 Abstracts, PSTR388.26/C44 (2023)

**VV:** Currently, gamma wave modulation technology is applied via use as a TV speaker. Is the technology available for other audio systems or is there a different way to implement it?

**Tsuji:** We have been contacted by various businesses interested in implementing gamma wave modulation technology for other audio systems.

Our corporate vision is, by leveraging our proprietary wave control technology, to serve as an incubator supporting innovative ideas to implement and create socially meaningful products. Any corporate and academic collaborations are welcome.

#### **VV Comments after the interview:**

It is a brilliant idea to integrate preventive care into daily life with the relaxation of TV viewing without worrying about Alzheimer's disease. It seems also a valuable therapy for people demonstrating some symptoms.

A WHO report describes<sup>2</sup> that in 2019, dementia of which 60 to 70% of cases are Alzheimer's disease, cost economies globally 1.3 trillion USD. Approximately 50% of these costs are attributable to care provided by informal carers such as family members and close friends. They spend on average five hours of care and supervision per day.

Alzheimer's disease starts many years before symptoms are diagnosed. It makes sense to prevent disease before symptoms noticeably manifest and severely progress. Obviously, patients suffering from Alzheimer's disease are mostly elderly. A research article published in 2022<sup>3</sup> reports that "it is estimated that, by 2050, there will be 152 million people with Alzheimer's disease and other dementia.... Given that the onset is closely related to age, the disease burden is expected to increase with the aging population and increased life expectancy."

The gamma wave modulation technology could be a de facto standard if it is incorporated into a variety of audio systems in private as well as public spaces. Considering that Alzheimer's disease has a limited cure now, it may certainly be an effective ameliorative care solution.

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<sup>2</sup> <https://www.who.int/news-room/fact-sheets/detail/dementia>

<sup>3</sup> <https://www.frontiersin.org/articles/10.3389/fnagi.2022.937486>

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