INVESTMENT MEMORANDUM

BEDY

rocking bed for adults

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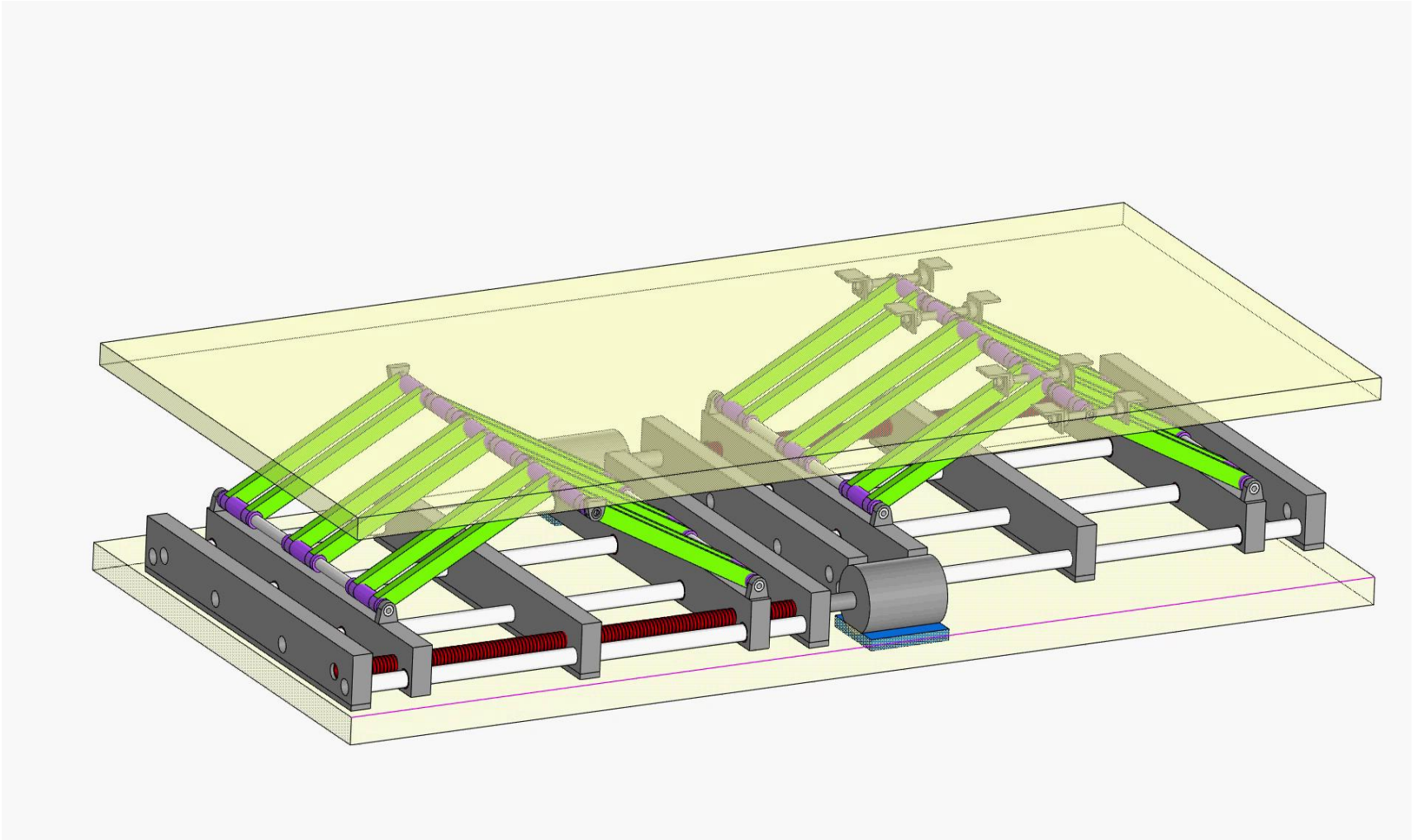

CONTENT

Summary

Advances in technology have not solved the problem of sleep, pain, migraine, stress, anxiety, and panic attacks: people continue to suffer, their numbers increasing over time. There are no safe medications to fall asleep quickly, sleep soundly, get rid of pain, migraine, stress anxiety and panic attacks. Therefore, doctors recommend a combination of pharmacological and non-pharmacological therapies, especially autotraining, relaxation and breathing techniques.

But mastering the skills of relaxation, autotraining and breathing techniques is long and difficult. It takes several months before the first results come, during which time many people lose confidence and stop practicing.

Audio-visual stimulation (AVS) helps to master relaxation skills and breathing techniques: children and adults like to fall asleep to soft, pleasant music, AVS is used to reduce and eliminate pain, prevent migraines and panic attacks.

We decided to make relaxation easily achievable - convenient, pleasant and effective for users, natural and unnoticeable, not requiring training, disguising it as a rocking procedure that has been pleasing people since infancy.

We learned how to gently lull adults like babies in a rocking cradle, simultaneously with pleasant relaxing music or special sound and visual stimulation for fast falling asleep. We used a specially designed rocking bed, which is noise-free and vibration-free, and synchronous multisensory stimulation technology (SMSST), in which the main effect is on the user's vestibular apparatus, and the accompanying effects are tactile and audiovisual.

We relied on research studies with results published in peer-reviewed scientific journals showing that vestibular stimulation reduces falling asleep time and improves sleep quality.

Restoring breathing in sleep through a conditioned breathing reflex formed in which the external stimulus is a synchronized effect on the user's vestibular apparatus and touch is a novel, previously unused way to normalize breathing and counter snoring and sleep apnea.

We used SMSST to pleasantly relax users in order to relieve pain, anxiety, worry, negative psychosomatic effects, prevent migraine attacks and panic attacks. Because relaxation, autotraining and breathing exercises are widely used for these purposes, and we added vestibular effects. We hypothesized that SMSST could be an adjunct to medications, existing medical devices, or act on its own, which would require research, objective evaluation, and unbiased results.

Beds are not only used for resting and sleeping. We hypothesized that SMSST would be useful to people for sensual relationships. Developing optimal SMSST algorithms for different purposes is a completely new challenge. We know how to train our AI on focus groups using accurate contact detectors, medical devices for sleep measurement and electroencephalogram (EEG) recording to further define SMSST algorithms based on non-contact detector performance, without medical devices.

Restoration of breathing in sleep due to the formed conditioned breathing reflex (Bedy Active Breath technology), in which the external stimulus is a synchronous effect on the vestibular apparatus and touch of the user, is a new, not used before method of normalization of breathing, counteraction to snoring and sleep apnea. Bedy Active Breath technology, working in conjunction with adjustable mattresses, can provide an alternative to CPAP masks, jaw or peri-mandibular mouth guards, implants and other devices placed on the head or in the mouth that reduce the user's comfort while sleeping.

With Bedy Active Breath technology, users' sleep quality is improved by eliminating the main cause of spontaneous awakenings - breath-holding, increasing the duration of N3 deep slow-wave sleep, providing improved memory and cognitive performance.

Our single and double rocking beds are functionally supports for flat or adjustable mattresses. We are targeting the consumer markets in North America and Europe. In the future, entry into the medical device market is possible.

We patent all of our technical solutions and technologies. We have tested rocking beds and have had amazing results that have confirmed our hypotheses, the main ones being that people of all ages enjoy rocking, people like to fall asleep while being gently rocked, relaxation results are quickly achieved with SMSST.

Sleep 7

Sleep is one of the most underrated and poorly understood phenomena of human life. Sleep cannot be replaced by anything, sleep does not come by force of will, it cannot be bought, borrowed, or rewarded. Every 20 years, scientific knowledge about sleep changes dramatically, but remains far from understanding the nature, evolution, biochemistry and neurophysiology of sleep.

Sleep is inextricably linked to consciousness, being its flip side, defined as the antipode of consciousness. That is, it is not defined at all, just like consciousness itself. Understanding sleep is as difficult a problem as the difficult problem of consciousness.

In sleep, consciousness leaves the person, and the senses lose touch with reality. On the face of it, sleep is a more than questionable endeavor from an evolutionary perspective, especially for those not at the top of the food chain. The conscious choice of sleep conditions and its restorative effects are crucial to natural selection.

Sleep is an absolute physiological necessity for humans: sleep deprivation or restriction leads inevitably to death.

Humans sleep according to circadian rhythms. They do not hibernate like bears, nor can they sleep separately with left and right hemispheres like dolphins or seals.

Humans have not learned how to regulate the transition from wakefulness to sleep, nor have they found a recipe for quality sleep. To date, there are no safe drugs, devices or apps to fall asleep quickly and improve sleep quality.

There are ways related to breathing control that provide calming, relaxation and reduction of psycho-emotional tone for quick transition from wakefulness to sleep, but not all people have the patience and will to acquire such skills.

During night sleep each person goes through four to six complete cycles of slow and rapid (or paradoxical) sleep, and if during slow sleep brain

activity decreases, then during rapid sleep, when dreams are dreamed, its intensity does not differ from the brain activity of the awake person.

Night and daytime sleep differ significantly: most adults do without daytime sleep. Daytime sleep is restorative in nature, contributing to increased performance and improved cognitive abilities, so many people like to sleep in the afternoon, and in the offices of some companies there are “quiet rooms” in which you can nap for 20-25 minutes during the working day, there are “quiet capsules” and hotels for short-term daytime sleep for all comers.

A good night's sleep is taken for granted, but a bad night's sleep becomes a nightmare for its possessor. Long-term observations have shown that poor sleep leads to an increased risk of cancer, cardiovascular disease, Alzheimer's disease and diabetes, negatively affecting immunity, memory and cognitive abilities, psychological well-being and, in general, the quality and duration of life.

It is safe to say that there is a direct link between sleep quality, productivity and human longevity.

Sleep breathing disorders - from mild snoring to severe forms of obstructive sleep apnea - are the most common causes of poor sleep that reduce sleep quality, cause blood pressure spikes, spontaneous awakenings and poor well-being.

Most often, prolonged tedious falling asleep and poor sleep are not associated with diagnosable diseases, the treatment of which requires medication and medical procedures, but with the natural process of aging and associated neurodegenerative changes, the effects of excitement and stress of everyday life, individual characteristics of the nervous system, flights between different time zones.

Regardless of the nature of poor sleep, its consequences are always negative. People have realized the importance and value of sleep, created a huge market of sleep products with hundreds of billions of dollars, invented Sleep Tech and Consumer Sleep Technology, but have not started sleeping better. Because there are no simple ways to get a good night's sleep.

A good mattress and a comfortable blanket are important - they have a psychosomatic effect on the user, making them feel good in bed through the release of pleasure hormones. But they do not help you sleep better or

prevent spontaneous awakening, snoring or sleep apnea. And when falling asleep, psychosomatics does not always and not everyone works. A good mattress and a comfortable blanket have no functional mechanism of influence on a sleeping person with a high feedback rate, capable of improving the breathing of the sleeper or improving the quality of his sleep.

Pain 10

Pain is an unpleasant or distressing sensation or experience of physical or emotional suffering. Pain serves as a protective signal of real or perceived tissue damage or psychological well-being; pain can be caused by disorders in the nervous system or one of the symptoms of a disease.

A distinction is made between acute pain, chronic pain, somatic pain, skin pain, internal pain, phantom pain, neuropathic pain (neuralgia), malignant pain, psychogenic pain, pathological pain, and mental pain.

The distinction of pain is due to its sources. Pain can be caused by the action of chemicals on the thermal receptors of the nervous system. Prolonged pain is accompanied by changes in physiological parameters (blood pressure, pulse, pupil dilation, changes in the concentration of hormones). Acute pain is accompanied by changes in hemodynamics, it is associated with stimulation of the sympatho-adrenal system. According to changes in the parameters of which it is possible to understand how intense the pain is (objective pain parameters).

Chronic pain of moderate to severe intensity is a widespread phenomenon in the world: up to 20% of the population suffer from chronic pain of various types. Pharmacologic treatment alone has a limited effect and increases the risk of addiction. Pain results from a complex interaction of biological, psychological and social factors. Pain can be understood as an interaction of activated pain fibers, pain interpretation, and pain behavior. Thus, pain is both a subjective experience and a physical sensation with significant individual differences.

Chronic pain persists longer than the time period in which it should normally end. It is often more difficult to treat than acute pain and requires special attention.

Establishing a pain mechanism prevents possible damage to the body, but chronic pain is pain without biological value and has no beneficial effects. The most common types of chronic pain are back pain, severe headache, migraine and facial pain. Chronic pain can cause very serious psychological and physical effects that sometimes last for the rest of your life. Damage to the gray matter of the brain, insomnia, sleep deprivation,

metabolic problems, chronic stress, obesity and heart attack, depression, cognitive disorders, feelings of injustice, neuroticism are examples respectively of physical and mental disorders caused by chronic pain.

Drug therapy - types of opioid and non-opioid medications, cognitive behavioral therapy, and physical therapy are used to treat chronic pain. Medications are usually associated with side effects and are prescribed when the effects of pain become severe or difficult to tolerate. Aspirin and ibuprofen, are used for mild pain, and morphine and codeine for severe pain. Other treatments, behavioral therapy and physical therapy, are used as adjuncts to medications due to lack of research and not always proven effectiveness.

Chronic pain is considered a kind of disease. This type of pain has affected the people of the world more than diabetes, cancer and heart disease. Several epidemiologic studies conducted in different countries have reported large variations in the prevalence of chronic pain ranging from 8% to 55.2% in different countries.

Studies estimate the incidence in Iran and Canada between 10% and 20%, and in the United States between 30% and 40%. The results show that on average 8% to 11.2% of people in different countries suffer from severe chronic pain, and its epidemic is higher in industrialized countries than in other countries. The American Medical Association estimates that the costs associated with this disease are 560-635 billion SUS per year.

Relaxation & Audiovisual Stimulation (AVS) 12

Relaxation is one of the frequently used non-pharmacological methods of physical and mental calming and relaxation used to fall asleep, reduce and overcome pain, anxiety, and prevent possible negative states.

The relaxed state achieved by relaxation often includes feelings of psychological and bodily well-being and tranquility. The goal of relaxation is to reduce the activity of the sympathetic nervous system. The practice of relaxation is associated with a decrease in blood pressure, oxygen consumption, respiratory rate, heart rate, and muscle tension. Relaxation techniques have several physiologic effects - lowering cortisol levels and inhibiting inflammation. The effectiveness of relaxation depends on the length of time practiced.

There are several different types of relaxation techniques - meditation, breathing techniques, visualization, autogenic training, and progressive muscle relaxation. One possible explanation for why relaxation techniques relieve chronic pain is that chronic pain is maintained and intensified by psychological stress and physical tension.

It has been estimated that it takes three months of regular relaxation practice to achieve pain reduction, and its effectiveness depends on both individual differences and types of chronic pain.

Various relaxation techniques related to reducing muscle and psycho-emotional tone, calming down and slowing down breathing are the gold standard for non-medication to achieve falling asleep quickly and sleeping soundly, reducing pain, preventing migraines, anxiety and panic attacks. With the exception of acute forms of psychiatric disorders, relaxation has no contraindications and is effective to use. The obstacle for many is the long period of time to learn relaxation techniques (three months or more) and the need to follow simple rules of healthy lifestyle and sleep hygiene.

Relaxation is mastered faster and more effectively with synchronous external sensory influence accompanied by positive emotions of the user (i.e. with the production of pleasure hormones) - pleasant quiet music with the rhythm of breathing or audiovisual stimulation with biofeedback.

Audio-visual stimulation (AVS) is used to improve psycho-emotional state or cognitive functions and more often refers to physiotherapy - non-therapeutic influence on the human senses to achieve beneficial results.

The principle of AVS is based on stimulation of the central nervous system (CNS) with specific visual and sound signals of different frequencies. These signals affect the brain in different ways, depending on the sounds coming from speakers or headphones, and the light signals and video images displayed on a screen or through special glasses.

The effects of AVS on humans have been studied in many scientific monographs, reviews and articles. Electroencephalogram (EEG) studies have shown changes in brain activity when exposed to visual and acoustic signals. AVS is effective for insomnia, pain reduction, migraine prevention, and sedation, one of the problems for AVS research is the lack of standards, making it difficult to systematically review and consolidate the scientific literature.

The development of relaxation and AVS has been facilitated by advances in portable EEG devices, which have become available for use not only in hospitals and laboratories, but also in the home, eliminating uncomfortable masks with gel-smeared electrodes.

AVS is usually used in conjunction with breathing exercises to promote relaxation, but there are techniques in which AVS is a stand-alone way to achieve results.

Relaxation and AVS for sleep

Problems falling asleep and staying asleep affect nearly one-third of adults who experience chronic insomnia or persistent difficulty falling asleep or staying asleep. However, for those who do not suffer from insomnia, tossing and turning in bed after a busy day is a familiar experience.

Stress and anxiety are often the cause of sleep problems. When the body's stress response is activated, it can be difficult to fall asleep and stay asleep. Research has shown that it is possible to turn off the stress response by activating another natural process called the relaxation response and help yourself naturally drift into sleep.
When falling asleep or dreaming, specially selected AVS sound and light frequencies affect the user's hearing and vision, influencing their brain activity. Experiments have confirmed that AVS promotes relaxation, falling asleep and better sleep.
Many people (up to half of all adults and children) constantly or occasionally use a simplified version of AVS when falling asleep - listening to quiet meditative music to relax and reduce psycho-emotional tone, trying to calm their thoughts and breathing.

In the last decade, there have been many startups in the field of sleep, in which relaxation and AVS are the instrument of influence: smart sleep masks, mobile applications that select the optimal parameters of AVS for the user, smart nightlights and lamps, special home devices with AVS, which are used by tens of millions of people. The number of people using AVS devices is constantly growing due to their simplicity, cheapness, efficiency and harmlessness of use.

AVS devices and apps for falling asleep and sleeping:

- Hatch smart lamps and lights with music (www.hatch.co)
- Mija Bedside Lamp smart lights (www.mijia-shop.com)
- AVS smartphone app Calm (www.calm.com)
- Galaxy & Star Projectors smart nightlights with music from various manufacturers
- Mindalive audio visual stimulation products (www.mindalive.com)
- AVS smartphone apps Mesmerize (www.mesmerizeapp.com)

- AVS sleep mask LC-dolida (www.thelcdolida.com)
- Elemind headphone foreheadband (www.elemindtech.com)
- Caputron Neuromodulation Devices (www.caputron.com)
- Modius Sleep Neuromodulation Device (www.neurovalens.com)
- Nervous system toning device with sound and infrasound Sensate (www.getsensate.com).

Scientific publications on the effects of AVS on falling asleep and sleep quality:

- RESEARCH ARTICLE| DECEMBER 09 2020. “Audio-visual stimulation for improving sleep quality” Muhammad Irsyad; Prihartini Widiyanti; Akif Rahmatillah. Author & Article Information *AIP Conf. Proc.* 2314, 030016 (2020) https://doi.org/10.1063/5.0034989

- Hyeyeoun Joo, Hyunwoo Nam, Dae Lim Koo, Jeh-Kwang Ryu, Sunkyue Kim, Kyoung-Min Lee «The effect of audio–visual stimulation on sleep quality» September 2019 IBRO Reports 6:S436 DOI:10.1016/j.ibror.2019.07.1383

- MEASUREMENT SCIENCE REVIEW, Volume 6, Section 2, No. 4, 2006 67 Short-term effects of audio-visual stimulation on EEG M. Teplan, A. Krakovská, S. Štolc Institute of Measurement Science, Slovak Academy of Sciences, Dúbravská cesta 9, 841 01 Bratislava, Slovakia.

- 0393 «Open-Loop Audio-Visual Stimulation for Insomnia in Older Adults with Osteoarthritis Pain» J Tang, S M McCurry, B Riegel, K C Pike, M V Vitiello. *Sleep*, Volume 41, Issue suppl_1, April 2018, Pages A149–A150, https://doi.org/10.1093/sleep/zsy061.392 Published: 27.04.2018

- «Pre-sleep alpha brainwave entrainment by audio or visual stimulation for people with chronic pain and sleep disturbance; a feasibility study» Stephen J. Halpin, NIcole Tang, Alex Casson, Anthony Jones, Rory J. O'Connor, Manoj Sivan. EEE - Academic & Research, Division of Neuroscience, University of Leeds, Leeds Teaching Hospitals NHS Trust, Leeds Community Healthcare NHS Trust.
- Tang, HY., Vitiello, M.V., Perlis, M. *et al.* Open-Loop Neurofeedback Audiovisual Stimulation: A Pilot Study of Its Potential for Sleep Induction in Older Adults. *Appl Psychophysiol Biofeedback* 40, 183–188 (2015). https://doi.org/10.1007/s10484-015-9285-x

- Tang, H. Y., Vitiello, M. V., Perlis, M., Mao, J. J., & Riegel, B. (2014). A pilot study of audio–visual stimulation as a self-care treatment for insomnia in adults with insomnia and chronic pain. *Applied Psychophysiology and Biofeedback, 39*(34), 219–225. doi:10.1007/s10484-014-9263-8.

- “The effect of auditory stimulation using delta binaural beat for a better sleep and post-sleep mood: A pilot study” Roya Dabiri, Mohammad Reza Monazzam Esmaielpour, Mojahede Salmani Nodoushan, Farin khaneshenas, Seyed Abolfazl Zakerian Digit Health. 2022 Jan-Dec; 8: 20552076221102243. Published online 2022 May 20. doi: 10.1177/20552076221102243 PMCID:PMC9125055

- “A feasibility study of pre-sleep audio and visual alpha brain entrainment for people with chronic pain and sleep disturbance” Stephen J. Halpin, Alexander J. Casson, Nicole K. Y. Tang, Anthony K. P. Jones, Rory J. O’Connor, Manoj Sivan. Front Pain Res (Lausanne) 2023; 4: 1096084. Published online 2023 Feb 23. doi: 10.3389/fpain.2023.1096084 PMCID:PMC9996154

- “Lightening the mind with audiovisual stimulation as an accessible alternative to breath-focused meditation for mood and cognitive enhancement” Micah Alan Johnson, Ninette Simonian, Nicco Reggente Sci Rep. 2024; 14: 25553. Published online 2024 Oct 26. doi: 10.1038/s41598-024-75943-8 PMCID:PMC11513117.

Relaxation and AVS to reduce, manage and prevent pain

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Relaxation is one of the commonly used non-pharmacologic ways to reduce and manage pain. A relaxed state often includes feelings of psychological and bodily well-being and calmness. The goal of relaxation techniques is to reduce sympathetic nervous system activity by inducing the opposite stress response.

Practicing relaxation techniques involves reducing blood pressure, oxygen consumption, breathing rate, heart rate, and muscle tension. Relaxation techniques have several detectable physiological effects - lower cortisol levels and inhibition of inflammation. Relaxation has been linked to overcoming stress and relieving anxiety. It has been shown experimentally that stress relief after relaxation practice depends on the duration of relaxation practice.

There are several different types of relaxation techniques. The explanation for the reduction in chronic pain with relaxation techniques is that psychological stress and physical exertion support and reinforce pain.

It has been estimated that three months of regular relaxation practice is required to achieve a reduction in chronic pain, and its effectiveness depends on both individual differences and types of chronic pain, as well as the individual's personality.

AVS is widely used to reduce, eliminate and prevent chronic pain of various types as a stand-alone method and as an element of relaxation techniques combined with breathing exercises. The effectiveness of AVS application depends on the user's involvement, trust in the method and determination.

Pain countermeasures devices with AVS:
- The Sana Health device mask (www.sana.io)
- Roxiva lamp (www.roxiva.com)
- David Premier,Delight,Delight Plus complexes (www.mindalive.com)
- Complexes EMDR (https://emdrtech.com)
- Soterix Medical Complexes (www.soterixmedical.com)
- INTO device (www.in.to).

Scientific publications on the effects of AVS on pain control:

- https://www.nature.com/articles/s41598-024-75943-8 Johnson, M., Simonian, N. & Reggente, N. «Lightening the mind with audiovisual stimulation as an accessible alternative to breath-focused meditation for mood and cognitive enhancement». Nature *Sci Rep* 14, 25553 (2024). https://doi.org/10.1038/s41598-024-75943-8

- https://www.sciencedirect.com/science/article/abs/pii/S0169260722002802
Computer Methods and Programs in Biomedicine Volume 223, August 2022, 106898 *Salvatore Saiu*, *Enrico Grosso* "Controlled audio-visual stimulation for anxiety reduction".

- https://www.sciencedirect.com/science/article/abs/pii/S0169260720317259 Computer Methods and Programs in Biomedicine Volume 200, March 2021, 105892 Diana Barsasella, Megan F. Liu, Shwetambara Malwade, Cooper J Galvin, Eshita Dhar, Chia-Chi Chang, Yu-Chuan Jack Li, Shabbir Syed-Abdul "Effects of Virtual Reality Sessions on the Quality of Life, Happiness, and Functional Fitness among the Older People: A Randomized Controlled Trial from Taiwan"

- https://www.sciencedirect.com/science/article/abs/pii/S0169260710002890
Computer Methods and Programs in Biomedicine Volume 102, Issue 1, April 2011, Pages 17-24 Teplan, A. Krakovská, S. Štolc "Direct effects of audio-visual stimulation on EEG"

- https://doi.org/10.1007/s11916-024-01246-2 Moreau, S., Thérond, A., Cerda, I.H. et al. "Virtual Reality in Acute and Chronic Pain Medicine: An Updated Review". Curr Pain Headache Rep 28, 893–928 (2024).

- https://link.springer.com/article/10.1007/s11916-024-01258-y Hou, TW., Yang, CC., Lai, TH. *et al.* Light Therapy in Chronic Migraine. *Curr Pain Headache Rep* 28, 621–626 (2024). https://doi.org/10.1007/s11916-024-01258-y

- https://www.spandidos-publications.com/10.3892/etm.2021.10055
Experemental and Therapeutic Medicine Weihua Hu, Ke Yang, Li Zhang, Xu Lu. Published online on: April 14, 2021 https://doi.org/10.3892/etm.2021.10055 Article Number: 623 "Effect of media distraction (audio- visual and music) for pain and anxiety control in patients undergoing shock- wave lithotripsy: A systematic review and meta- analys"

- https://link.springer.com/article/10.1007/s10484-014-9263-8
Tang, HY., Vitiello, M.V., Perlis, M. *et al.* A Pilot Study of Audio–Visual Stimulation as a Self-Care Treatment for Insomnia in Adults with Insomnia and Chronic Pain. *Appl Psychophysiol Biofeedback* 39, 219–225 (2014). https://doi.org/10.1007/s10484-014-9263-8

- Budzynski, T., Budzynski, H., Sherlin, L., & Tang, H. Y. (2011). Audio–visual stimulation: Research and clinical practice. In J. Berger & G. Turow (Eds.), *Music, science, and the rhythmic brain* (pp. 137–153). New York.

- https://pmc.ncbi.nlm.nih.gov/articles/PMC9996154/
«A feasibility study of pre-sleep audio and visual alpha brain entrainment for people with chronic pain and sleep disturbance» Stephen J. Halpin, Alexander J. Casson, Nicole K. Y. Tang, Anthony K. P. Jones, Rory J. O'Connor, Manoj Sivan. Front Pain Res (Lausanne) 2023; 4: 1096084. Published online 2023 Feb 23. doi: 10.3389/fpain.2023.1096084

- https://onlinelibrary.wiley.com/doi/10.1002/ejp.960 European Journal of pain Volume21, Issue3 March 2017 Pages 562-572. K. Ecsy, A.K.P. Jones, C.A. Brown "Alpha-range visual and auditory stimulation reduces the perception of pain". First published: 02 November 2016 https://doi.org/10.1002/ejp.960

- https://pmc.ncbi.nlm.nih.gov/articles/PMC8405991/
Heliyon. 2021 Aug 20;7(8):e07837. doi: 10.1016/j.heliyon.2021.e07837 "Relaxation techniques as an intervention for chronic pain: A systematic review of randomized controlled trials".
Sara Magelssen Vambheim , Tonje Merete Kyllo, Sanne Hegland, Martin Bystad

- Cochrane Database Syst Rev. 2018 Mar 28;2018(3):CD009514. https://pmc.ncbi.nlm.nih.gov/articles/PMC6494625/ «Relaxation techniques for pain management in

labour» Caroline A Smith, Kate M Levett, Carmel T Collins, Mike Armour, Hannah G Dahlen, Machiko Suganuma Editor: Cochrane Pregnancy and Childbirth Group

- Bair M.J., Robinson R.L., Katon W., Kroenke K. Depression and pain comorbidity: a literature review. Arch. Intern. Med. 2003;163(20):2433–2445. doi: 10.1001/archinte.163.20.2433.

- Benson H. William Morrow and company; New York: 2000. Relaxation Response.

- Benson H. Simon & Schuster; New York: 2010. Relaxation Revolution.

- Bhasin M.K., Dusek J.A., Chang B.H., Joseph M.G., Denninger J.W., Fricchione G.L., Libermann T.A. Relaxation response induces temporal transcriptome changes in energy metabolism, insulin secretion and inflammatory pathways. PloS One. 2013;8(5) doi: 10.1371/journal.pone.0062817.

- Breivik H., Collett B., Ventafridda V., Cohen R., Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. Eur. J. Pain. 2006;10:287–333. doi: 10.1016/j.ejpain.2005.06.009.

- Bush V., Magerl W., Kern U., Haas J., Hajak G., Eichhammer P. The effect of deep and slow breathing on pain perception, autonomic activity, and mood processing – an experimental study. Pain Med. 2012;13(2):215–228. doi: 10.1111/j.1526-4637.2011.01243.x.

- Bushnell C.M., Čeko M., Low L.A. Cognitive and emotional control of pain and its disruption in chronic pain. Nat. Rev. Neurosci. 2013;14:502–511. doi: 10.1038/nrn3516.

- Chang B.H., Dusek J.A., Benson H. Psychobiological changes from relaxation response elicitation: long-term practitioners versus novices. Psychosomatics. 2011;52:550–559. doi: 10.1016/j.psym.2011.05.001.

- Chen Y.L.E., Francis A.J. Relaxation and imagery for chronic, nonmalignant pain: effects on pain symptoms, quality of life, and mental health. Pain Manag. Nurs. 2010;11(3):159–168. doi: 10.1016/j.pmn.2009.05.005.

- Concato J., Shah N., Horwitz R.I. Randomized controlled trials, observational studies and the hierarchy of research designs. N. Engl. J. Med. 2000;342:1887–1892. doi: 10.1056/NEJM200006223422507.

- Coppieters I., Cagnie B., Nijs J., Van Oosterwijck J., Danneels L., De Pauw R., Meeus M. Effects of stress and relaxation on central pain modulation in chronic whiplash and fibromyalgia patients compared to healthy controls. Pain Physician. 2016;19(3):119–130.

- Dunford E., Thompson M. Relaxation and mindfulness in pain: a review. Reviews in Pain. 2010;4:18–22. doi: 10.1177/204946371000400105.

- Edwards P., Clarke M., DiGuiseppi C., Pratap S., Roberts I., Wentz R. Identification of randomized controlled trials in systematic reviews: accuracy and reliability of screening records. Stat. Med. 2002;21:1635–1640. doi: 10.1002/sim.1190.

- Edwards R.R., Dworkin R.H., Sullivan M.D., Turk D.C., Wasan A.D. The role of psychosocial processes in the development and maintenance of chronic pain. Am Pain Soc. 2016;17(9):70–92. doi: 10.1016/j.jpain.2016.01.001.

- Fillingim R.B. Individual differences in pain: understanding the mosaic that makes pain personal. Pain. 2017;158(1):11–18. doi: 10.1097/j.pain.0000000000000775.

- Finnerup N.B. Nonnarcotic methods of pain management. N. Engl. J. Med. 2019;380:2440–2448. doi: 10.1056/NEJMra1807061.

Relaxation to prevent migraine attacks 19

Relaxation, based on breathing and focusing or distracting the mind, has been used by people and cultures for thousands of years to manage pain and stress. It is an innate human response: in the event of pain, a deep breath is taken.

Research shows that behavioral therapies can be effective in preventing migraine attacks and/or reducing the intensity and duration of attacks when they occur. Biofeedback, relaxation therapy, and cognitive-behavioral therapy have good evidence for preventing a certain percentage of attacks, reducing the number of days with headache, and improving quality of life and other variables for people with migraine. Efficacy rates in migraine prevention are similar to those of traditional oral therapies for migraine prevention.

Studies of mindfulness-based migraine treatments, which are less common and have recently emerged, have shown improved quality of life, reduced disability, reduced symptoms of depression and anxiety, and other positive outcomes. However, the degree of migraine attack prevention has varied from person to person and from study to study.
There are many healthy practices that people can learn whether or not they participate in behavioral therapies. Someone can learn and practice rhythmic breathing, guided visual imagination, or meditation on their own.

Relaxation techniques help calm the sympathetic nervous system and activate the parasympathetic nervous system. The parasympathetic nervous system controls the “rest and digest” functions and the body's relaxation response, which includes slowing the heart rate, improving circulation throughout the body and relaxing muscles, among other functions. Activation of the parasympathetic nervous system helps counteract the sympathetic nervous system, which controls the “hit or run” response that can be triggered by stress, pain and other experiences.

In a person with migraine, the nervous system is very sensitive to both non-external and internal changes. External changes, such as an approaching storm or a change in barometric pressure, as well as internal changes, such as hormonal fluctuations, lack of sleep or a stressful period, can affect the nervous system and lead to an increased likelihood of a migraine attack.

Regularly practicing relaxation and healthy lifestyle habits builds resilience in the nervous system so that it can better withstand internal and external changes. Practicing relaxation and healthy lifestyle habits can raise the threshold of an attack or add some defense. By practicing rhythmic breathing, mindful meditation, or other relaxation exercises for 20 minutes several times a week, as well as getting enough exercise and quality sleep, it is possible to raise your migraine attack threshold.

Devices for migraine countermeasures:

- Cefaly (www.cefaly.com) is a headband-like device that sends electrical impulses that stimulate nerve cells associated with migraine.
- Spring TMS or eNeura sTM (www.eneura.co.uk) - a device for people with pre-migraine aura that delivers a magnetic pulse that stimulates the part of the brain associated with migraines
- GammaCore (www.gammacore.com) non-invasive vagus nerve stimulator (NVN) - a hand-held device placed over the vagus nerve in the neck that stimulates nerve fibers to relieve pain
- Nerivio (www.nerivio.com) - a wireless nerve-altering device worn on the forearm for migraines.

Scientific publications on the effects of relaxation on migraine counteraction:

- Psychological therapies for the prevention of migraine in adults
https://pmc.ncbi.nlm.nih.gov/articles/PMC6603250/
Louise Sharpe, Joanne Dudeney, Amanda C de C Williams, Michael Nicholas, Ingrid McPhee, Andrew Baillie, Miriam Welgampola, Brian McGuire, Cochrane Pain, Palliative and Supportive Care Group Cochrane Database Syst Rev. 2019; 2019(7): CD012295. Published online 2019 Jul 2. doi: 10.1002/14651858.CD012295.pub2 PMCID:PMC6603250

- Migraine and sleep disorders: a systematic review
https://pmc.ncbi.nlm.nih.gov/articles/PMC7590682/ Cindy Tiseo, Alessandro Vacca, Anton Felbush, Tamara Filimonova, Annalisa Gai, Tatyana Glazyrina, Irina Anna Hubalek, Yelena Marchenko, Lucas Hendrik Overeem, Serena Piroso, Alexander Tkachev, Paolo Martelletti, Simona Sacco, on behalf of the European Headache Federation School of Advanced Studies (EHF-SAS) J Headache Pain. 2020; 21(1): 126. Published online 2020 Oct 27. doi: 10.1186/s10194-020-01192-5 PMCID:PMC7590682

- Regular Practice of Autogenic Training Reduces Migraine Frequency and Is Associated With Brain Activity Changes in Response to Fearful Visual Stimuli
https://pmc.ncbi.nlm.nih.gov/articles/PMC8814632/ Dóra Dobos, Edina Szabó, Dániel Baksa, Kinga Gecse, Natália Kocsel, Dorottya Pap, Terézia Zsombók, Lajos R. Kozák, Gyöngyi Kökönyei, Gabriella Juhász Front Behav Neurosci. 2021; 15: 780081. Published online 2022 Jan 21. doi: 10.3389/fnbeh.2021.780081 PMCID:PMC8814632

- The American Headache Society Consensus Statement: Update on integrating new migraine treatments into clinical practice. Ailani J, Burch RC, Robbins MS; Board of Directors

of the American Headache Society.Headache. 2021 Jul;61(7):1021-1039. doi: 10.1111/head.14153. Epub 2021 Jun 23.PMID: 34160823

- Anxiety and depression symptoms and migraine: a symptom-based approach research.
Peres MFP, Mercante JPP, Tobo PR, Kamei H, Bigal ME.J Headache Pain. 2017 Dec;18(1):37. doi: 10.1186/s10194-017-0742-1. Epub 2017 Mar 21.PMID: 28324317 Free PMC article.

- Relaxation training for management of paediatric headache: A rapid review.
Thompson AP, Thompson DS, Jou H, Vohra S.Paediatr Child Health. 2019 May;24(2):103-114. doi: 10.1093/pch/pxy157. Epub 2019 Feb 7.PMID: 30996601 Free PMC article. Review.

- Biofeedback and relaxation-response training in the treatment of pediatric migraine.
Fentress DW, Masek BJ, Mehegan JE, Benson H.Dev Med Child Neurol. 1986 Apr;28(2):139-46. doi: 10.1111/j.1469-8749.1986.tb03847.x.PMID: 3519327 Clinical Trial.

- Relaxation training and written emotional disclosure for tension or migraine headaches: a randomized, controlled trial. D'Souza PJ, Lumley MA, Kraft CA, Dooley JA.Ann Behav Med. 2008 Aug;36(1):21-32. doi: 10.1007/s12160-008-9046-7. Epub 2008 Aug 12.PMID: 18696172 Free PMC article. Clinical Trial.

Relaxation and AVS to prevent anxiety, worry and panic attacks

22

Stress and anxiety are common among most people because they are a natural part of the “hit, run or freeze” response that prepares the body to meet danger. It is a normal response to threatening situations that helped people survive dangers, natural disasters, and animal attacks in prehistoric times. The stress response is activated to help people survive various forms of physical and mental trauma when there is a threat or immediate danger to life.

Past traumatic experiences and problems in everyday life can also trigger the stress response and make you feel anxious. Stress, worry and anxiety can become overwhelming, negatively impacting lifestyle and affecting daily well-being.

It is impossible to avoid stressful situations, but it is possible to develop effective ways of responding to sources of stress, anxiety and worry. There are specialized stress management techniques to quickly calm the mind and body.

Relaxation combined with specialized breathing and biofeedback techniques is an effective non-drug way to get rid of stress, anxiety and worry, and prevent panic attacks. Relaxation and meditation are more effective with an external influence that sets the rhythm of breathing, so AVS is widely used to increase the effectiveness of relaxation.

Amazon's Marketplace (www.amazon.com) has over 600 products in the “Anxiety-device” category under the “Health Care” subsection.

Anxiety and Stress Prevention Devices and Devices:

- Modius Stress Neuromodulation Device (www.neurovalens.com)
- Neuromodulation device sound and infrasound Sensate (www.getsensate.com)
- Apollo (www.apolloneuro.com) Vagus nerve toning sound wave vibration calming and sleep device (www.apolloneuro.com)
- Wearable tactile stimulation devices The Touch Point (www.thetouchpointsolution.com)

- Alpha-Stim cranial electrotherapy (CES) and mycortical electrotherapy (MET) devices (www.alpha-stim.com)
- Biofeedback sedation and sleep devices (www.bio-medical.com)
- GoRoga Stress Reduction Devices (www.corporate.goroga.in)
- Smartphone apps «Worry Tree», «Moodfit», «Freedom», «Alan Minnd», «HeadGear», «Calm».

Scientific articles on the effects of relaxation on overcoming stress, anxiety, worry and panic attacks:

- Antidepressants versus placebo for panic disorder in adults
Irene Bighelli, Mariasole Castellazzi, Andrea Cipriani, Francesca Girlanda, Giuseppe Guaiana, Markus Koesters, Giulia Turrini, Toshi A Furukawa, Corrado Barbui, Cochrane Common Mental Disorders Group Cochrane Database Syst Rev. 2018; 2018(4): CD010676. Published online 2018 Apr 5. doi: 10.1002/14651858.CD010676.pub2 PMCID: PMC6494573

- Biobehavioral approach to distinguishing panic symptoms from medical illness
Natalie C. Tunnell, Sarah E. Corner, Andres D. Roque, Juliet L. Kroll, Thomas Ritz, Alicia E. Meuret Front Psychiatry. 2024; 15: 1296569. Published online 2024 May 8. doi: 10.3389/fpsyt.2024.1296569 PMCID:PMC11109415

- Panic disorder in general medical practice- A narrative review
Narayana Manjunatha, Dushad Ram J Family Med Prim Care. 2022 Mar; 11(3): 861–869. Published online 2022 Mar 10. doi: 10.4103/jfmpc.jfmpc_888_21
PMCID:PMC9051703

- Psychological therapies for panic disorder with or without agoraphobia in adults: a network meta-analysis Alessandro Pompoli, Toshi A Furukawa, Hissei Imai, Aran Tajika, Orestis Efthimiou, Georgia Salanti, Cochrane Common Mental Disorders Group Cochrane Database Syst Rev. 2016 Apr; 2016(4): CD011004. Published online 2016 Apr 13. doi: 10.1002/14651858.CD011004.pub2PMCID:PMC7104662

- Panic-Focused Psychodynamic Psychotherapy in a Woman with Panic Disorder and Generalized Anxiety Disorder Larry Sandberg, Fredric Busch, Franklin Schneier, Andrew Gerber, Eve Caligor, Barbara Milrod Harv Rev Psychiatry. Author manuscript; available in PMC 2016 May 18. Published in final edited form as: Harv Rev Psychiatry. 2012 Sep-Oct; 20(5): 268–276. doi: 10.3109/10673229.2012.726527PMCID:PMC4871148

- Psychological therapies versus pharmacological interventions for panic disorder with or without agoraphobia in adults Hissei Imai, Aran Tajika, Peiyao Chen, Alessandro Pompoli, Toshi A Furukawa, Cochrane Common Mental Disorders Group Cochrane Database Syst Rev. 2016; 2016(10): CD011170. Published online 2016 Oct 12. doi: 10.1002/14651858.CD011170.pub2
PMCID:PMC6457876

- Anxiety as a disorder of uncertainty: implications for understanding maladaptive anxiety, anxious avoidance, and exposure therapy Vanessa M. Brown, Rebecca Price, Alexandre Y. Dombrovski Cogn Affect Behav Neurosci. Author manuscript; available in PMC 2024 Jun 1.
Published in final edited form as: Cogn Affect Behav Neurosci. 2023 Jun; 23(3): 844–868. Published online 2023 Mar 3. doi: 10.3758/s13415-023-01080-w
PMCID:PMC10475148

- Sleep and anxiety disorders Luc Staner Dialogues Clin Neurosci. 2003 Sep; 5(3): 249–258. doi: 10.31887/DCNS.2003.5.3/lstaner
PMCID:PMC3181635

The psychological and physiological effects of AVSS can be significant. Studies have shown that exposure to sexually explicit material can increase sexual arousal as measured by physiological responses. AVSS can influence an individual's sexual attitudes, beliefs, and behaviors, potentially shaping their sexual preferences and expectations. The effects of AVSS on sexual health and relationships can be complex and depend on a variety of factors, including the content of the materials, the context in which they are used, and individual differences in response.
The types and content of AVSS vary widely, reflecting a variety of sexual interests and preferences. They may include pornography, erotic art, and educational materials aimed at increasing sexual knowledge and interests. The internet has greatly increased access to AVSS, with numerous websites and platforms offering a wide range of sexual content.
The use of AVSS raises controversy and concerns about addiction and potential effects on sexual relationships and depictions of unsafe sexual practices. Some research suggests that excessive use of sexually explicit material can lead to negative consequences, such as decreased sexual satisfaction in relationships and increased risk-taking behaviors. In addition, the production and consumption of AVSS is subject to legal and ethical regulations, especially regarding consent, age, and protection of performers.
The human brain is intimately connected to sensory relationships. Visual and auditory stimuli, by acting on specific areas of the brain, trigger physiological responses associated with arousal. Music can create a mood, musical rhythm and melody can synchronize breathing and heart rate and increase arousal. Photos and videos can be romantic or sexually explicit, allowing you to create the right atmosphere and visualize fantasies, engage the story, stimulate the imagination.

AVSS has many positive effects:

- Obtaining desire - having sex with pleasant music or watching erotic videos can help achieve the right level of arousal.
- Harmonizing relationships - sensual pleasures are more pleasurable for partners when the rhythm is the same and climaxes at the same time.
- Increased pleasure - the right stimuli can increase sexual pleasure.

- Variety of sensuality - AVS tools allow you to experiment and discover new facets of sexuality of partners.

AVSS has found wide application in applications for smartphones and Sex Tech devices - creation of personalized audio-visual environment, augmented reality, visualization of fantasies, creation of attractive images, intimate toys, devices for realization of fantasies and much more. Sex Tech sector is growing at a fantastic CAGR of 17.2% until 2032 when it will reach a capacity of $US 113 billion.

The phenomenon of rocking 26

People have always rocked their babies. First they did it in their hands, then they invented cradles, bassinets, rocking beds, screwed to them different mechanisms, attached motors, video cameras, wireless communication, sound and motion sensors, forming a multi-billion dollar market of good children's sleep. For a long time, no one thought about the reasons for the positive effect of rocking on children, everyone just knew that when rocking children stop crying, calm down and fall asleep.

With the development of science it became clear that rocking is not just rhythmic rocking of the child, but a psychophysiological phenomenon formed in the womb and fixed during breastfeeding, which forms a sense of peace, comfort and safety that remains throughout a person's life. Every person has a memory of rocking as a state of peace, comfort and security, because rocking, cuddling, and feeding produce the pleasure hormones serotonin, endorphin, oxytocin and dopamine, which are the cause of feelings of happiness, peace and serenity.

Rocking in the womb is experienced by absolutely all people: when a pregnant woman walks, vertical movements of her torso are made, causing uniform vertical rocking of the water sac, picked up by the otolithic system of the vestibular apparatus of the human embryo. There are scientific hypotheses that the memories of a comfortable state of rest and security, received in the womb, accompany a person throughout his life.

It is the pleasure of rocking and the associated hormonal activity explains the popularity of furniture for rocking - rocking chairs, recliners, home swings, which are bought by millions, and on which are spent tens of billions of $US.

But children mostly sleep well, and teenagers also sleep well, and young people, in general, with sleep all right. But after 40 - as luck would have it, and after 60, sleep becomes a problem for most people. What can you do, age-related neurodegenerative changes can't be avoided by anyone.

It is surprising that adults, wanting to sleep like babies in the figurative sense, do not think about the actual possibility of such sleep and do not make any effort to achieve such sleep. Habit is a stubborn thing.

In scientific literature and medical journals there are many articles about the positive effect of cyclic vestibular stimulation (rocking) on rocking to sleep and sleep of adults, about the reduction of the time of falling asleep with rocking, about the possibility of forming breathing in sleep due to external stimuli. In university laboratories, devices have been created to study falling asleep and sleep under conditions of vestibular stimulation.

But while cradles, bassinets and rocking beds are leading the way in the infant sleep products industry, modern technology has left rocking without proper attention in the adult sleep products industry.

Since 2010, the Sensory Systems Laboratory (SMS Lab) at ETH Zurich has been conducting scientific research on the effects of rocking to sleep with the creation of several Somnomat laboratory rocking machines, which has led to a surge of interest in the effects of rocking to sleep and a large number of scientific publications and studies.

Scientific studies have confirmed the positive effects of vestibular stimulation (rocking to sleep) on the time of falling asleep and on sleep in general. Important are the positive results of the effects of rocking on the duration of the deep slow-wave sleep phase N3 and on memory consolidation (the transition of memory from short-term to long-term).

With an imperfect test methodology and a limited number of subjects, the positive results of rocking to sleep were published in Current Biology in 2010-2021 and in other scientific journals linked below.

Scientific publications in the field of rocking and vestibular stimulation during sleep:

- Non-Pharmacological Intervention for Personalizing Sleep Quality through Gentle Rocking Motion. Vulturar DM, Moacă LȘ, Chețan IM, Vesa ȘC, Alexescu TG, Grigorescu C, Trofor AC, Stoia MA, Nemes AF, Todea DA.J Pers Med. 2024 Feb 19;14(2):218. doi: 10.3390/jpm14020218.PMID: 3839265

- Effect of a Recliner Chair with Rocking Motions on Sleep Efficiency. Baek S, Yu H, Roh J, Lee J, Sohn I, Kim S, Park C.Sensors (Basel). 2021 Dec 8;21(24):8214. doi: 10.3390/s21248214.PMID: 34960304 Free PMC article

- Effect of Rocking Movements on Afternoon Sleep. van Sluijs RM, Rondei QJ, Schluep D, Jäger L, Riener R, Achermann P, Wilhelm E.Front Neurosci. 2020 Jan 21;13:1446. doi: 10.3389/fnins.2019.01446. eCollection 2019.PMID: 32038144 Free PMC article

- Whole-Night Continuous Rocking Entrains Spontaneous Neural Oscillations with Benefits for Sleep and Memory. Perrault AA, Khani A, Quairiaux C, Kompotis K, Franken P, Muhlethaler M, Schwartz S, Bayer L.Curr Biol. 2019 Feb 4;29(3):402-411.e3. doi: 10.1016/j.cub.2018.12.028. Epub 2019 Jan 24.PMID: 30686735

- Woodward, S.; Tauber, E.S.; Spielman, A.J.; Thorpy, M.J. Effects of Otolithic Vestibular Stimulation on Sleep. Sleep 1990, 13, 533–537.

- Chalmers, R.; Howard, R.; Wiles, C.; Spencer, G. Use of the Rocking Bed in the Treatment of Neurogenic Respiratory Insufficiency. QJM Int. J. Med. 1994, 87, 423–429.

- Bayer, L.; Constantinescu, I.; Perrig, S.; Vienne, J.; Vidal, P.-P.; Mühlethaler, M.; Schwartz, S. Rocking Synchronizes Brain Waves during a Short Nap. Curr. Biol. 2011, 21, R461–R462.

- Mölle, M.; Born, J. Slow Oscillations Orchestrating Fast Oscillations and Memory Consolidation. In Progress in Brain Research; Elsevier: Amsterdam, The Netherlands, 2011; Volume 193, pp. 93–110. ISBN 978-0-444-53839-0.

- Ngo, H.-V.V.; Martinetz, T.; Born, J.; Mölle, M. Auditory Closed-Loop Stimulation of the Sleep Slow Oscillation Enhances Memory. Neuron 2013, 78, 545–553.

- Morita, Y.; Yamaguchi, K.; Ashida, K.; Ikeura, R.; Yokoyama, K. Verification of Sleep-Inducing Effect by Excitation Apparatus Simulating Mother's Embrace and Rocking Motion. In Proceedings of the 9th International Workshop on Robot Motion and Control, Kuslin, Poland, 3–5.07. 2013; pp. 80–85.

- Del Vecchio, F.; Nalivaiko, E.; Cerri, M.; Luppi, M.; Amici, R. Provocative Motion Causes Fall in Brain Temperature and Affects Sleep in Rats. Exp. Brain Res. 2014, 232, 2591–2599.

- Ashida, K.; Morita, Y.; Ikeura, R.; Yokoyama, K.; Ding, M.; Mori, Y. Effective Rocking Motion for Inducing Sleep in Adults - Verification of Effect of Mothers Embrace and Rocking Motion. J. Robot. Netw. Artif. Life 2015, 1, 285.

- Crivelli, F.; Omlin, X.; Rauter, G.; Von Zitzewitz, J.; Achermann, P.; Riener, R. Somnomat: A Novel Actuated Bed to Investigate the Effect of Vestibular Stimulation. Med. Biol. Eng. 2016, 54, 877–889.

- Omlin, X.; Crivelli, F.; Heinicke, L.; Zaunseder, S.; Achermann, P.; Riener, R. Effect of Rocking Movements on Respiration. PLoS ONE 2016, 11, e0150581.

- Shibagaki, H.; Ashida, K.; Morita, Y.; Ikeura, R.; Yokoyama, K. Verifying the Sleep-Inducing Effect of a Mother's Rocking Motion in Adults. J. Robot. Netw. Artif. Life 2017, 4, 129–133.

- Kimura, H.; Kuramoto, A.; Inui, Y.; Inou, N. Mechanical Bed for Investigating Sleep-Inducing Vibration. J. Healthc. Eng. 2017, 2017, 2364659.

- Omlin, X.; Crivelli, F.; Näf, M.; Heinicke, L.; Skorucak, J.; Malafeev, A.; Fernandez Guerrero, A.; Riener, R.; Achermann, P. The Effect of a Slowly Rocking Bed on Sleep. Sci. Rep. 2018, 8, 2156.

- Perrault, A.A.; Khani, A.; Quairiaux, C.; Kompotis, K.; Franken, P.; Muhlethaler, M.; Schwartz, S.; Bayer, L. Whole-Night Continuous Rocking Entrains Spontaneous Neural Oscillations with Benefits for Sleep and Memory. Curr. Biol. 2019, 29, 402–411.e3.

- Kompotis, K.; Hubbard, J.; Emmenegger, Y.; Perrault, A.; Mühlethaler, M.; Schwartz, S.; Bayer, L.; Franken, P. Rocking Promotes Sleep in Mice through Rhythmic Stimulation of the Vestibular System. Curr. Biol. 2019, 29, 392–401.e4.

- van Sluijs, R.M.; Rondei, Q.J.; Schluep, D.; Jäger, L.; Riener, R.; Achermann, P.; Wilhelm, E. Effect of Rocking Movements on Afternoon Sleep. Front. Neurosci. 2020, 13, 1446.

- van Sluijs, R.; Wilhelm, E.; Rondei, Q.; Omlin, X.; Crivelli, F.; Straumann, D.; Jäger, L.; Riener, R.; Achermann, P. Gentle Rocking Movements during Sleep in the Elderly. J. Sleep Res. 2020, 29.

- Muto, T.; Yoshizawa, M.I.; Kim, C.; Kume, K. Sleep-Improving Effects of a Novel Motion Mattress. Sleep Biol. Rhythm. 2021, 19, 247–253.

- Baek, S.; Yu, H.; Roh, J.; Lee, J.; Sohn, I.; Kim, S.; Park, C. Effect of a Recliner Chair with Rocking Motions on Sleep Efficiency. Sensors 2021, 21, 8214.

- Park, K.S.; Choi, S.H.; Yoon, H. Modulation of Sleep Using Noninvasive Stimulations during Sleep. Biomed. Eng. Lett. 2023, 13, 329–341.

- A.Subramaniam, A.K.Eberhard-Moscicka, M.Ertl and F.W. Mast. Rocking Devices and the Role of Vestibular Stimulation on Sleep—A Systematic Review. Clin. Transl. Neurosci. 2023, 7, 40.

Sleep breathing 30

The problems of breathing during falling asleep and during sleep are topical in medicine and physiology. Currently, specialized scientific journals “Sleep and Breathing” and “Sleep and Biological Rhythms” are published, the titles of which reveal their topics.

The problems of sleep respiratory failure - snoring and obstructive sleep apnea - are massive, with Obstructive sleep apnea (OSA) alone affecting more than 74 million Americans, nearly 22% of the total U.S. population, most of whom have undiagnosed OSA. Sleep apnea causes spontaneous awakenings, reduces blood oxygen saturation, causes pressure spikes, and carries negative cardiac consequences and risk of sudden death.

At the World Sleep Forum held in Rio de Janeiro (Brazil) on 20-25.10.2023, more than half of the participants specialized in the treatment of sleep apnea, which best characterizes the urgency of the problem.

Sleep-disordered breathing is primarily managed with continuous pressure air mask (CPAP). In addition, there are surgical methods, special jaw or peri-mandibular mouth guards, implants, devices that elevate the upper torso, and smartphone apps. All of these devices and treatments have varying degrees of effectiveness that are significantly lower than CPAP masks, the use of which is effective but extremely uncomfortable.

The possibilities of shaping the breathing of a falling asleep or sleeping person under the influence of external stimuli, described in scientific articles, have spurred entrepreneurs to create consumer devices to improve or restore breathing:

- Moonbird (www.moonbird.life) is an expanding and contracting device placed in the palm of a person falling asleep. The external stimulus is cyclic tactile stimulation in the hand. Initially the respiratory reflex is formed consciously synchronously with the cyclic tactile stimulation, later the reflexive breathing is unconsciously synchronized with the sensory stimulation.

- Somnox (www.somnox.com) is a robotic bag pressed against the abdomen that stimulates the diaphragm to contract and shape the breathing of a falling asleep and sleeping person. Direct stimulation of breathing is carried out in conjunction with the formed conditioned respiratory reflex. The external stimulus is cyclic tactile stimulation in the region of the umbilicus. Initially, the respiratory reflex is formed consciously synchronously with acting with cyclic stimulation of touch and direct stimulation of breathing, later the reflexive breathing is carried out unconsciously synchronously with sensory stimulation and direct stimulation of breathing.

- Dodow (www.mydodow.com) is a rhythmic light source that pulsates in time with breathing and shapes the breathing of the falling asleep and sleeping person. The external stimulus is the cyclic stimulation of the falling asleep person's vision. Initially, the breathing reflex is formed consciously synchronously with the cyclic stimulation of vision, later the reflexive breathing is unconsciously synchronized with sensory stimulation.

- 2 breathe (www.2breathe.com) - a smartphone app to help you breathe slowly and deeply has evolved into resperate.com, a wearable device that rhythmically influences hearing and shapes breathing to counteract hypertension.

- SleepCogni (www.sleepcogni.com) - a device placed in the palm of a person falling asleep. The external stimulus is cyclic tactile stimulation of the hand. Initially, the respiratory reflex is formed consciously synchronously with cyclic tactile stimulation, and later reflexive breathing is unconsciously synchronized with sensory stimulation.

Restoration and normalization of breathing in sleep due to external stimuli - research and publications in peer-reviewed scientific journals:

- Closed-Loop Auditory Stimulation to Guide Respiration: Preliminary Study to Evaluate the Effect on Time Spent in Sleep Initiation during a Nap.
Yoon H, Choi SH.Sensors (Basel). 2023 Jul 17;23(14):6468. doi: 10.3390/s23146468.PMID: 37514760

- Respiration-triggered olfactory stimulation reduces obstructive sleep apnea severity: A prospective pilot study.
Perl O, Kemer L, Green A, Arish N, Corcos Y, Arzi A, Dagan Y.J Sleep Res. 2024 May 13:e14236. doi: 10.1111/jsr.14236. Online ahead of print.PMID: 38740050

- Gentle rocking movements during sleep in the elderly.

van Sluijs R, Wilhelm E, Rondei Q, Omlin X, Crivelli F, Straumann D, Jäger L, Riener R, Achermann P.J Sleep Res. 2020 Dec;29(6):e12989. doi: 10.1111/jsr.12989. Epub 2020 Feb 15.PMID: 32061115

Mert A, Klopping-Ketelaars I, Bles W.Ann N Y Acad Sci. 2009 May;1164:173-9. doi: 10.1111/j.1749-6632.2008.03735.x.PMID: 19645896

- Entrainment of respiration to rocking in premature infants: coherence analysis. Sammon MP, Darnall RA.J Appl Physiol (1985). 1994 Sep;77(3):1548-54. doi: 10.1152/jappl.1994.77.3.1548.PMID: 7836164

- Rassler B, Raabe J (2003) Co-ordination of breathing with rhythmic head and eye movements and with passive turnings of the body. European Journal of Applied Physiology 90: 125–130. - PubMed

Mattress and bed 32

Once upon a time, beds for sleeping were a great asset, they were cared for, cherished, and the best and worst bed was specified in a will. Today, a bed is a standard-sized mattress pad. Faceless and uninteresting.

The U.S. population is 336 million, the vast majority of whom sleep on mattresses at night. People are comfortable and accustomed to sleeping, being sick, resting, and making love on a fixed, (not always) flat, moderately firm surface.

Mattresses are durable and relatively inexpensive, with a lifespan of about 10 years, and 36 million new mattresses are purchased in the United States each year. Falling asleep and sleeping on a soft mattress is familiar, comfortable and pleasant, and neither the shape, functionality nor design of mattresses has fundamentally changed for decades.

There are hundreds of online and offline mattress sellers, whose products and business models are easy to copy, so the competition in this market is incredible, and bright startups often fail to survive the competition and their own growth.

Mattresses are rarely on the floor, they are on beds: it is more familiar, comfortable, hygienic and aesthetically pleasing. The bed is a fixed support for the mattress, which has not changed for centuries. Choosing a place to sleep, people first of all choose a comfortable mattress on which they lie, physically the bed does not affect the person lying on the mattress.

Beds and mattresses are made to standard sizes so that one mattress can be easily swapped for another or one bed (mattress pad) for another mattress pad (bed). Bed and mattress do not compete with each other for the likes and hearts of users, but functionally complement each other.

With the development of technology, there are mattresses with shape, temperature and hardness adjustment c AI, sensors that measure the physiological parameters of the user, vibromassage and other contrivances.

But this has not changed the nature of sleep, rest, cure from diseases and lovemaking, which remained the same on a fixed, (not always) flat, moderately hard surface.

Problem 34

People combine conservatism with the urge for innovation. When they want to sleep better, they do not want to sleep anywhere but on the moderately firm mattresses they are used to. Mattresses that create the comfort users are accustomed to have (almost) no mechanisms to influence the senses, helping them to fall asleep faster and sleep more soundly, to relax more effectively, to heal faster, to make love more pleasant. Beds, which are mattress supports, have no effect on users at all, except that they squeak under load, causing laughter or irritation.

Advances in technology have not changed the sleep problem: adults continue to sleep poorly on their familiar fixed beds, and their numbers are increasing over time. There are no safe sleep medications, so somnologists recommend learning to fall asleep using relaxation and breathing techniques.

Dreaming of sleeping like babies in the figurative sense - falling asleep quickly, sleeping without waking up, waking up rested and full of energy - adults have not thought about the real possibility of such a dream. Infants and adults sleep differently: infants in rocking beds, but adults in fixed beds.

Migraines affect more than a billion people in the world. Various chronic pain, anxiety and anxiety states, and panic attacks are experienced by just as many people. Completely safe medications do not exist, all medications affecting the brain, without exception, have adverse reactions. Therefore, doctors recommend a combination of medication and non-medication therapies: relaxation, special breathing, biofeedback methods, which can become more effective when used in conjunction with AVS.

We surveyed consumers in different countries about various non-pharmacological ways to fall asleep quickly, to get quality sleep without spontaneous awakenings, to get rid of and prevent chronic pain, migraine, anxiety and restlessness. We received the expected answers about the extreme importance of such ways, but the simultaneous inconvenience, difficult to achieve or low effectiveness.

After analyzing non-pharmacological ways recommended by physicians and used by users, we concluded that relaxation, which provides physical relaxation and reduced psycho-emotional tone, is a universal way to solve problems of falling asleep, sleep, pain, stress, anxiety, and more. But relaxation skills are difficult to achieve for most - they require adherence to rules and routines, a long period of training, persistence and determination to get results.

We realized that our task is to make relaxation comfortable, pleasant and effective for users. That is, natural and invisible, disguising it as a familiar rocking procedure, which has been a pleasure for people since infancy. For this purpose, it was necessary to change the beds in order to keep their usual shape and size and radically change their functionality.

Solution 36

We decided that the pleasure users get when using our bed should make a significant difference. We decided to influence the vestibular apparatus of users by providing them with the pleasure of rocking and a rhythm for breathing.

We decided to gently lull adults like babies in a rocking cradle, simultaneously with pleasant relaxing music or special sound and visual effects for fast falling asleep. We used a specially designed rocking bed and synchronous multisensory stimulation technology (SMSST), in which the main effect is on the user's vestibular apparatus, and the accompanying effects are tactile and audiovisual.

We drew on existing scientific research with results published in peer-reviewed scientific journals showing that vestibular stimulation reduces falling asleep time and improves sleep quality.
Restoration of breathing in sleep due to the formed conditioned respiratory reflex, in which the external stimulus is a synchronous effect on the vestibular apparatus and touch of the user, is a new, not used before method of normalization of breathing, counteraction to snoring and sleep apnea.

Peculiarities of physiology of the vestibular apparatus allow to apply this method of restoration of breathing of the user in sleep, without waking up the user. That is, having formed the habit of the user to breathe synchronously with the rise and fall of the rocking bed, and repeating it many times, it is possible to form a conditioned respiratory reflex as a reaction to the sensory excitation of the vestibular apparatus with additional tactile influence.

At occurrence of respiratory insufficiency of the user in a dream or at threat of its spontaneous awakening, the movable substrate of rocking bed will begin to carry out reciprocating movements, at the user “triggers” the formed conditional reflex - there will be a reflexive breathing in a tact of raising and lowering of the movable substrate of rocking bed. The breathing technology is called Bedy Active Breath.

The effectiveness of the formation of conditioned breathing reflex will increase if conscious breathing during reciprocating movements of the rocking bed will be accompanied by the production of pleasure hormones. In addition, raising the user's head by changing the shape of the mattress located on the movable substrate of the rocking bed, accompanied by a decrease in throat swelling and an increase in the respiratory passage, will also have a beneficial effect on the effectiveness of the formation of reflexive breathing.

A distinctive feature of Bedy Active Breath technology is the absence of special masks, jaw or peri-mandibular mouth guards, implants and other devices placed on the head or in the mouth, hoses and wires that make it difficult to turn over in sleep and reduce the comfort of the user in sleep. Bedy Active Breath technology dramatically improves the quality of sleep of users by eliminating the main cause of spontaneous awakenings - breath-holding, increasing the duration of deep slow-wave sleep N3, providing improved memory and cognitive abilities.

Bedy Active Breath technology is not effectively used with horizontal motion along the longitudinal or transverse horizontal axis, and it is impossible to perform vestibular simulation, excluding direct impact on the user's vestibular apparatus.

Ilya Voronin filed a provisional patent application with the United States Patent and Trademark Office (USPTO) for “Apparatus and Method of Synchronized Sensory Stimulation”, in which he disclosed the principle of operation of a software and hardware complex of a rocking device with audio-visual influence, affecting the vestibular apparatus, vision, hearing and touch of a person falling asleep or asleep, the essence and principles of synchronized multisensory stimulation technology (SMSST), the essence and principles of Bedy Active Breath technology.

We used SMSST to pleasantly relax users in order to get rid of pain, anxiety, worry, negative psychosomatic effects, prevent migraine attacks and panic attacks. We hypothesized that SMSST could be an adjunct to medications, existing medical devices, or act independently, which would require research, objective evaluation, and unbiased results.

Beds are not just for resting and sleeping on. We hypothesized that SMSST would be useful for people to have sensual relationships. Developing optimal SMSST algorithms for different purposes is a completely new challenge. We know how to train our AI on focus groups using accurate contact detectors, medical devices for sleep measurement

and electroencephalogram (EEG) recording to further determine SMSST algorithms based on the performance of non-contact detectors, without medical devices and appliances.

From a functional standpoint, we have expanded the list of senses on which relaxation effects are produced to achieve sleep, rest, relaxation, pain relief, migraine and panic attack prevention, or stimulus effects for sensory pleasures. We added to the standard audiovisual relaxation effects for achieving sleep, rest, relaxation, pain relief, migraine and panic attack prevention, or stimulating effects for sensory pleasures, vestibular effects and associated effects on the user's touch.

That is, we've made the sensory impact more effective because the human senses are only six, and we've engaged four of them and are thinking about how to use the fifth one, the sense of smell, effectively.

The proof is in the love people of all ages have for rocking furniture: rocking chairs, recliners and home swings sell millions of pieces worth billions of $US annually.

We didn't change anything about the mattress design because it's not our business, leaving the choice of mattress model up to the user. We envisioned that the mattress could be plain flat or packed with sensors, with adjustable shape, temperature or firmness or whatever.

People have always used their beds for sleep, sex, rest, relaxation, pain relief and preventing panic attacks and migraine attacks, but using a rocking bed with SMSST technology allows you to do all this with much greater efficiency that is fundamentally impossible to achieve with conventional fixed beds. Vestibular stimulation cannot be simulated or replaced by a smartphone app.

It's all about the human hormonal system: smooth rocking shapes the rhythm of breathing and triggers the production of pleasure hormones.

The main products planned are a single and double rocking bed for the consumer market with flat, non-transformable, movable substrates for overnight sleep and a single rocking bed with a similar substrate for short-term daytime sleep.

Additional products with similar rocking units to be developed at a later date include single bed rocking beds for the medical market, a rocking recliner designed for rest and short daytime sleep, a rocking Nap Pod designed for short daytime sleep, single and double rocking beds equipped with movable substrates with a transformable shape, rocking beds whose support bases are equipped with swivel or non-swivel bases, and rocking beds with a swivel or non-swivel bed base.

All of the above types of single and double rocking beds, rocking recliners, and Nap Pods have been described in detail in a provisional patent application to the USPTO entitled “Rocking Bed and Rocking Device” (Provisional Application 63/666,724).

The rocking bed has a modular design consisting of 10 modules:

- support base,
- electrical power supply,
- lifting mechanism (1 or 2 electric motors with lifting mechanical or hydraulic or hybrid power drive),
- support system,
- a flat non-transformable movable substrate or a shape-transformable movable substrate,
- internal and external noise and vibration isolation system,
- cooling and warm air utilization system,
- control system, interactive communication with the user and with external networks, user safety system.

On top of the flat non-transformable movable substrate is attached a mattress, which may be flat or with an adjustable shape. A flexible mattress is attached to the transformable movable substrate from above, which can be shaped in the same way as the transformable movable substrate.

The design of the rocking unit and the working principles of the rocking bed, recliner and Nap Pod are not fundamentally different from each other, but their functionality may have differences to reduce cost.

The main principles of rocking beds, rocking chair-recliner and rocking Nap Pod - no noise and vibration, smooth movement, sufficient power of the power unit to achieve acceleration, perceived by the otolithic system of the human vestibular apparatus, a wide range of frequency, amplitude, shape (mode) of movement.

These principles are achieved by using modern low-speed collectorless DC electric motors on permanent magnets, advanced control system, no contact of moving metal parts in the structure, double-circuit system of sound and vibration protection.

Rocking beds, rocking chair-recliner and rocking Nap Pod are powered by household electricity, models with a support base equipped with swivel wheels have electric batteries. All product types operate under the common Canopen or EtherCat communication protocols. When developing product components, a custom data transfer protocol can be developed.

Rocking beds, rocking recliners and Nap Pods operate under the control of a high-level controller that receives and sends data to external servers to collect, process and analyze information.

The cost of rocking beds, rocking recliners and Nap Pods depends significantly on the cost of electronic, mechanical and hydraulic components, which should be developed and produced by the company itself or by contract manufacturing without excessive functionality, rather than purchased from third-party manufacturers.

Rocking bed

A rocking bed is a mattress support with a movable top side, called the movable substrate, and a fixed bottom side, called the support base. All elements of the rocking bed are attached to the upper surface of the support base.

The movable substrate is driven by mechanical, hydraulic or hybrid mechanical and hydraulic actuators (movers) attached by their fixed parts to the support base or to the movable carriages of the linear motion axis, and by their movable parts to the lower surface of the movable substrate.

The flat, non-transformable movable substrate may have one or two degrees of freedom: plane-parallel movement relative to a vertical axis in a horizontal or inclined position (one degree of freedom), plane-parallel movement relative to a vertical axis, rotation relative to a transverse or longitudinal axis, and a superposition of said movement and rotation (two degrees of freedom). If the support base is equipped with wheels, the movable substrate may additionally acquire up to three degrees of freedom - horizontal movement, rotation relative to the vertical axis and superposition thereof.

The movable substrate of the sleeping place can be transformable in form, consisting of several flat independent and dependent elements, in this case a flexible mattress repeating the form of the transformable substrate is attached thereto, and the number of degrees of freedom of the transformable movable substrate depends on the number of independent elements and types of fastening of the movers (actuators) thereto.

The flat movable substrate is driven by one or two dependent actuators (one degree of freedom) or two independent actuators (two degrees of freedom).

The design of the rocking bed, the number of degrees of freedom of the flat non-transformable or transformable movable substrate depends on the design of the support system acting in conjunction with hydraulic, mechanical or hybrid actuators. The support system provides strength and horizontal stability of the rocking bed in static or dynamic operation, and enables the rocking bed to be used as stationary furniture.

The rocking bed does not require attachment to the ceiling, floor or wall, the shape and dimensions of the rocking bed are the same as those of a conventional fixed bed.

The rocking bed with a flat non-transformable substrate allows the use of any mattress on the market - a regular flat mattress, an adjustable shape mattress, an adjustable mattress, an adjustable temperature mattress, an adjustable firmness mattress, or a mattress that has all adjustments at the same time, or a regular mattress without adjustments of any design.

Hydraulic power drive

The hydraulic lifting mechanism (hydraulic power drive) comprises two hydraulic cylinders, at least piston cavities of which are hydraulically

connected to each other, one of which is in a vertical position with its cage attached to the upper surface of the rocking bed support base and its rod attached to the lower surface of the movable substrate and is the direct mover; the other hydraulic cylinder is in a horizontal position with its cage stationary and attached to the rocking bed support base and is the direct mover

When the rotor of the electric motor rotates the screw of the linear motion axis, the movable carriage is moved by the nut (or ball screw or roller screw), as a result of which the rod attached to the carriage and the piston of the horizontally positioned hydraulic cylinder also move, pushing the hydraulic fluid from the piston cavity of the horizontally positioned hydraulic cylinder into the piston cavity of the vertically positioned hydraulic cylinder, as a result of which the piston is pushed out of the piston cavity of the horizontally positioned hydraulic cylinder into the piston cavity of the vertically positioned hydraulic cylinder.

Reversal is accomplished by the gravity of the user, the mattress and the movable substrate when the hydraulic fluid is forced out of the piston cavity of the vertical hydraulic cylinder into the piston cavity of the horizontal hydraulic cylinder, moving the carriage of the linear motion axis, with the electric motor acting as an electric power generator. The position of the moving substrate is monitored in real time by a linear displacement sensor, the information from which is fed to the electric motor driver and to a high-level controller.

Similar lifting and lowering processes occur when not only piston cavities but also rod cavities are hydraulically connected. When using double rod or pseudo double rod hydraulic cylinders, the return stroke can occur due to the flow of hydraulic fluid from the piston cavity to the rod cavity of the vertically positioned hydraulic cylinder.

The reversal is accomplished by the gravity of the user, the mattress, and the movable substrate when the carriages “part” from the center stationary support and the electric motor acts as an electric power generator. The position of the movable substrate is monitored in real time by a linear motion sensor, the information from which is fed to the electric motor driver and a high-level controller.

In the above-described hydraulic design, hydraulic leverage is possible when the inner diameters of the horizontal and vertical hydraulic cylinders are not equal, which may result in an increase in the force on the rod of the vertical hydraulic cylinder or its displacement.

Mechanical Power Actuator

Mechanical power drive consists of an axis of linear motion, which has three fixed supports - the central and two lateral, between which differently equally move two moving carriages, which have a constant symmetrical position relative to the central fixed support due to the opposite direction of the thread of the screw, changing in the central support, and the screw is connected to the rotor of the electric motor, and moving carriages linearly move due to a pair of nut-screw (or screw-ball-screw-screw gear or screw-roller-screw).

When the rotor of the electric motor rotates the screw of the linear motion axis, the moving carriages move towards the central stationary support, the base of the isosceles triangle whose cathetes are the lifting rods decreases, and the height of the triangle increases, i.e. the upper horizontal axis is lifted.

Hybrid power train

The hybrid power drive is a combination of mechanical and hydraulic power drives. Instead of lifting rods, hydraulic lifting cylinders are used, whose cages are pivotally connected to the movable carriages from below and whose rods are pivotally connected to the upper horizontal axis from above. The rods of the lifting hydraulic cylinders are driven by one or more horizontally arranged hydraulic cylinders, the cages of which are stationary, and the rods are attached to the movable carriages. When the carriages move, the piston rod of the horizontally positioned hydraulic cylinder pushes hydraulic fluid into the lifting hydraulic cylinders, causing the lifting hydraulic cylinder rods to rise.

If the ratio of diameters of horizontal and lifting hydraulic cylinders is such that all hydraulic fluid passes from piston cavities of horizontal hydraulic cylinders into piston cavities of lifting hydraulic cylinders, i.e. any movement of the horizontal hydraulic cylinder rod causes the same movement of the lifting hydraulic cylinder rod, then the lifting formula: $\sqrt{(C+X)^2 - (L-X)^2}=\sqrt{(C+L)*(C-L+2X)}$, where X - movement of the carriage (rod) from the extreme (nearest to the side support) position, - half of the length of the maximum base of the triangle.

In the hybrid power drive, lifting is realized both by changing the position of the movable carriages and by extending the rods of the hydraulic lift cylinders: when the rotor of the electric motor rotates, the screw of the

linear motion axis rotates, causing movement of the movable carriages, to which the cages of the lifting hydraulic cylinders are hinged from below, and movement of the rod and piston (rods and pistons) of the horizontal hydraulic cylinders, as a result of which the pistons with the rods of the lifting hydraulic cylinders are extended.

The return stroke occurs in the same way under the influence of the gravity of the user, the mattress and the movable substrate as in hydraulic and mechanical power drives.

Modifications of the design with two independent screws have been developed to allow longitudinal movement of the movable substrate in addition to vertical movement.

When using two mechanical or hybrid power drives, the dynamic support of the rocking bed, which is necessary when using a hydraulic power drive, becomes redundant.

Attachment of the upper connecting axis, to which the lifting rods or rods of lifting hydraulic cylinders are attached, to the lower surface of the movable substrate in one drive is fixed, and in the other drive is sliding, to compensate for the increase in the linear distance between the attachment points of the connecting axes when the movable substrate is rotated relative to the transverse axis. The sliding attachment allows the upper connecting axis to move parallel to the fixed axis along cylindrical guides on which linear bearings are mounted to which, in turn, the upper connecting axis is attached.

Rocking bed models

All rocking bed models planned for development at this stage of the project have rigid flat movable substrates: a single bed has one movable substrate with two degrees of freedom, driven by two mechanical or hybrid power drives, a double bed has a common support base and two movable substrates, each of which is driven by two mechanical or hybrid power drives with two electric motors, i.e. has two degrees of freedom. The movable substrates of the twin rocking bed can move independently of each other or synchronously with each other.

All designs of lifting mechanisms have “floating” coordinates of the beginning and end of the lifting and lowering cycle, functionally adjustable frequency, amplitude and shape (mode) of movements in the range limited by the physical length of the moving part of the actuator.

Functional adjustment means that the propulsor moves not along a predetermined trajectory, for example, a sinusoid, with adjustable parameters of the sinusoid, but along any modeled and changeable at any time trajectory of the propulsor movements.

Rocking chair recliner

The main feature of the rocking chair-recliner consists in the possibility of rocking the user who is in the sitting, not transformed position of the chair-recliner, and in the lying position of the transformed (unfolded) chair-recliner.

The rocking recliner consists of two main elements - the rocking unit (rocking stand under the transformable seat) and the transformable seat, in which the user sits (in the folded state of the recliner) or lies down (in the unfolded state of the recliner). The functions of the legs of the rocking recliner chair are performed by the rocking unit. The lower part of the recliner seat is attached to the upper surface of the rocking block.

The Pre Seed stage of the Bedy project does not include the development of a rocking recliner chair. The economics of bringing recliner chairs to market and the expected demand will be investigated in later stages of the project.

Rocking Nap Pod

The Nap Pod is a common short-term daytime sleep device on the market, also known as the Sleep Pod, Metro Pod or Energy Pod.

The rocking Nap Pod retains the spatial design of the stationary Nap Pod. The Nap Pod is housed in a base and vertical stand, with actuators providing reciprocating movements of a movable mattress substrate, on which the user lies, within a stationary outer cocoon.

The feasibility of producing a lulling Nap Pod is a matter of upcoming marketing and consumer research. Being significantly more expensive than a rocking bed and a rocking convertible recliner, the Nap Pod is a niche product for the affluent with limited demand.

Gently rocking the Bedy rocking bed in sync with the AVS is a pleasant experience for the user or a couple of users when resting, falling asleep and waking up, but especially for sensual pleasures, because the gentle rocking produces pleasure hormones.

For this reason, for most people, resting, falling asleep or having sex on a Bedy rocking bed is more pleasurable than doing so on a fixed mattress.

Falling asleep in a Bedy rocking bed is faster than in a fixed bed, as proven by scientific experiments published in scientific journals.

Sleeping in a Bedy rocking bed is healthier than in a fixed bed: breathing is normalized, blood is oxygenated, and the duration of deep, slow N3 sleep is longer - proven by scientific experiments published in scientific journals.

The Bedy rocking bed design, Bedy Active Breath technology and synchronized multi-sensory stimulation technology have filed provisional patent applications with the USPTO for intellectual property protection and invention patents.

The Bedy rocking bed cannot be replaced by a fixed bed or simulate the effects on the user's vestibular system by software methods without the rocking process.

The Bedy rocking bed has no direct analogs with a similar design. Without exception, all models of rocking beds or furniture devices that provide rocking functions have transverse reciprocating movements with obvious disadvantages that cause discomfort to the user.

The Bedy rocking bed as a basic bed has vertical reciprocating motion, which other rocking bed models do not have, with no negative effects on the user.

Currently, there is no market for rocking beds due to the lack of adequate supply.

Among the huge number of rocking beds for children, there are several types of electrically powered rocking beds on the market for adults, which perform transverse reciprocating movements in the horizontal plane.

- Rocking bed (rockingbed.com) is a bed frame that performs transverse reciprocating movements of the mattress relative to a fixed base with an amplitude of 15-20 cm. Rocking bed was presented at CES 2019. The frame is priced at US$9,749.

- Ensven 2 (ensven.com) - 4 stands installed under the legs of the furniture, thanks to which the furniture performs reciprocating movements with an amplitude of 10-15 cm. The direction of movement depends on the orientation of the devices. The cost of a set of 4 stands (2 active and 2 passive) is 709 US$.

- Adiva one (adiva.co) - 4 stands installed under furniture, thanks to which the furniture makes reciprocating movements with the amplitude of 5 cm. The direction of movement depends on the orientation of the fixtures. The cost of a set of 4 stands (all 4 active) is 2499 Euro.

- Innova's product “Cruise” (www.innovasleep.com/product-features-explained) is a swinging mattress stand of pendulum type (in development, price is not specified, no technical specifications are given, the picture shows that cyclic reciprocating rotation with one degree of freedom relative to the horizontal transverse axis is performed).

- Somnomat Casa (product of the SMS ETH Zurich laboratory, ethambassadors.ethz.ch/2022/02/17/3-medtech-innovations-for-a-good-nights-sleep/), a home bed with wheels hidden inside the body, which performs longitudinal reciprocating movements; in addition, the headboard of the bed is able to rise and fall synchronously.

All horizontal rocking devices have certain disadvantages:

- Horizontal plane-parallel movements differ significantly from baby rocking in the arms and from fetal vibrations during intrauterine development when the mother is walking, where vertical movements are the main ones.

- Overcoming the resting friction, which is twice as high as the friction force during movement, requires powerful electric motors, which together with the small movement amplitude does not allow for smooth movements. This causes discomfort to the user. The consequence of the smoothness of the movement at small movement amplitude is a slight acceleration, which may not be picked up by the otolithic system of the user's vestibular apparatus.

- Transverse horizontal reciprocating movements create a torque acting on the user and trying to “turn over” the user in extreme points due to the location of the user's center of gravity at a distance from the surface of the mattress, which causes discomfort or discomfort when the user falls asleep and sleeps.

- All the presented systems when moving create noise and vibration of their own propulsors or squeak of the moved furniture due to loads and elastic deformations, which interferes with falling asleep and is not conducive to rest and sleep.

- Horizontal reciprocating movements of furniture of considerable weight are not safe for animals and small children, and in case of tipping of the furniture it can create a real threat to the health and life of children.

None of the manufacturers of the aforementioned seating devices has provided measured noise levels of their devices. None of the manufacturers of these devices have real videos demonstrating the operation of their devices with a real phonogram (sound). For the above reasons, such devices cannot promote sleep and sleep, and the demand for horizontal rocking devices is virtually nil.

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The main disadvantage of the above devices is the inconvenience and discomfort due to the functionality of transverse reciprocating movements of small amplitude.

None of the manufacturers justify the frequency of movement of their rocking bed or rocking device and do not tie it to the physiological characteristics of the user - breathing, heart rate, high-amplitude delta waves EEG or anything else.

The comfort, convenience and safety for the user(s) of Innova's rocking bed requires study. Functionally, it is a special case of the Bedy rocking bed with two degrees of freedom, where the thrusters are in counter-phase to each other.

No offerings on the market of rocking beds with vertical movement could be found. In Muto, T.; Yoshizawa, M.I.; Kim, C.; Kume, K. Sleep-Improving Effects of a Novel Motion Mattress. Sleep Biol. Rhythm. 2021, 19, 247-253 A variable shape pneumatic mattress with multiple vertical thrusters - air chambers filled with air from a compressor - is described. Air, unlike a liquid, has the properties of compression, expansion, and temperature change with changes in pressure, which makes it, like other gases, not a suitable substance for implementing cyclic reciprocating motion.

For the future rocking bed market, the potential Total Addressable Market is the entire market for beds as mattress pads that could theoretically be replaced by rocking beds, measured in volume terms at 250 million units in the US[1] .

Any calculation of SAM (Serviceable Available Market) and SOM (Serviceable & Obtainable Market) for the non-existent rocking bed market would be tentative and incorrect.
The existence of latent demand for adult sleep rockers is proven by a combination of several interrelated behavioral and consumer factors:

- The rocking habit of people of all ages, originated in the womb and reinforced by breastfeeding. This is why babies love to be rocked and adults think of rocking for rest, peace, relaxation or pleasure.

- The rocking habit of adults on rocking rocking chairs and recliners, whose market size was US$ 3.2[2] and 4.5[3] billion in 2023, whose consumption in the US (about a third of the market) is measured in millions of units per year.

- Abundance of rocking beds for adults without electric drive on the US market: mechanical, on curved slides, pendulum type with ceiling mount, for researching which it is enough to type “rocking bed” in a Google search.

- Growing consumption of traditional sleep products with modern high-tech features - smart and adjustable beds, with a market size of US$ 6.74 billion in 2022[4], in the U.S. US$ 2.54 billion at a CAGR of 8.8% through 2030.

- Long-term consumer interest in innovation in the Sleep Tech industry with a market size of US$ 16.1 billion in 2022 and an incredible projected CAGR of 22.6% to 2033[5].

- Long-term interest in innovation in the Sex Tech industry with a market size of US$ 31.9 billion in 2022 and a projected CAGR of 18.4% per annum over the next few years[6],

- Stable demand for baby rocking devices - rocking beds and rocking cradles that build the habit of rocking to sleep from childhood, estimated at US$ 2 billion in 2022[7], the market for smart rocking beds for babies is nascent and estimated at US$ 0.33 billion[8].

The demand for rocking beds for therapeutic purposes depends on the effectiveness of Bedy Active Breath technology, which will be determined by future scientific research. Bedy Active Breath technology could potentially replace or supplement CPAP masks, replace or supplement other anti-snoring and sleep apnea products, replace or supplement other anti-snoring devices, the markets for which are:

- CPAP[9] masks - US$2.76 billion in 2021, growing at a CAGR of 7.4% per year through 2030,
- anti-sleep apnea devices[10] - US$ 4.9 billion in 2022, growing at a CAGR of 7.3% per annum through 2032,
- anti-snoring devices[10] - US$ 1.33 billion in 2023, growing at a CAGR of 7.5% per annum to 2033.

[1] https://explodingtopics.com/blog/mattress-market

[2]https://www.verifiedmarketreports.com/product/global-rocking-chairs-market-report-2019-competitive-landscape-trends-and-opportunities/

[3] https://www.verifiedmarketreports.com/product/recliner-chairs-market/

[4] https://www.grandviewresearch.com/industry-analysis/adjustable-beds-mattress-market-report

[5]https://www.globenewswire.com/news-release/2023/03/06/2620813/0/en/Sleep-Tech-market-is-projected-to-grow-at-a-CAGR-of-22-6-by-2033-Visiongain-Reports-Ltd.htmL

[6]www.researchdive.com/8819/sextech-market

[7]https://www.thebrainyinsights.com/report/baby-cradle-market-13140

[8]https://www.sphericalinsights.com/reports/smart-crib-market

[9] https://straitsresearch.com/report/cpap-devices-market

[10] https://finance.yahoo.com/news/sleep-apnea-devices-market-size-004000083.htm

[11] https://finance.yahoo.com/news/global-smart-anti-snoring-device-110000872.htm

Users of rocking beds

The Bedy rocking bed, working together with Bedy Active Breath technology, has the potential to reach a wide range of users:

- people of all ages will be able to fall asleep faster, sleep without awakenings and get a better night's sleep, everyone will enjoy the pleasant rocking experience;

- elderly people with back or joint pains will be able to fall asleep in the comfortable position of the transformable mattress, which can assume a flat horizontal or inclined position, ensuring quality sleep for its user;

- people of all ages who are prone to various pains, migraine attacks, panic attacks, negative psychosomatic disorders, excessive anxiety;

- people of all ages who practice meditation;

- children and young people will love the unusual but very pleasant rocking on a rocking bed;

- young people a quality day or night's sleep will improve memory consolidation and enhance cognitive abilities;

- for middle-aged people, a short daytime nap will improve performance, well-being and psycho-emotional tone, and falling asleep in the evening will stop being long and tiring;

- health-conscious people of all ages will get a better quality of sleep than on any fixed bed;

- people suffering from respiratory depression, snoring or sleep apnea will have an alternative to surgery, dental mouth guards and CPAP masks;

- lovers of water beds will be able to feel strong effects and a more vivid experience than on water beds;

- lovers of new unusual things and new sensual experiences will be delighted with the rocking bed functionality of Bedy.

It's hard to imagine who the Bedy rocking bed wouldn't suit. It's like the cell phone revolution: before cell phones, everyone used landlines, but now everyone uses cell phones. Cell phones are more convenient, they are the next round of progress.

It's the same with rocking beds. They can be movable or stationary like regular beds. Rocking beds are more comfortable, they're the next step up.

The one success story

Water beds were invented in the III millennium BC, reinvented at the end of the XIX century and began to be produced in plastic shells in the United States at the junction of the 60's and 70's of the XX century.

At first, water beds were intended for people with problems with the musculoskeletal system and back pain. They were extremely uncomfortable: they weighed 500 kg, sharp objects and pets caused a flood and huge lawsuits from homeowners and neighbors below, it was difficult to turn over on them, the constant rocking was a test for the vestibular apparatus, and any movement caused a wave, especially noticeable for people with different weights.

But the enthusiasts of water beds were not people with orthopedic problems, but quite healthy young people, to whom water beds gave new bright impressions, which could not be obtained on conventional mattresses.

By 1986, waterbeds had 22% of the U.S. market!
Twenty-two percent!

And it would have been even more if it weren't for homeowner bans on waterbeds, which made them eligible for use in the California Civil Code (CIV § 1940.5).

Because they weren't like regular beds-they were different.

In the 70s, waterbeds became the manifesto of hippie youth, the epitome of the times, the spirit of freedom, drugs, and rock and roll.

“Click once get two free” - under this slogan not only waterbeds were sold, but also the Great Sexual Revolution, young people threw out spring mattresses from their windows, voting against the old boring world for new pleasures.

By the '80s, professional marketers, big chains and big business had taken over.

“Two things are better on a water bed. One of them is sleeping” is a great and very professional slogan. Water beds had a chic of dubious elitism, a flair of unprecedented sensual pleasures, a trail of available erotic fantasies (one Hugh Hefner on a huge water bed with black silk sheets was worth it!).

Consumers were not at all enticed by stories of comfortable sleep, and not at all comfortable sleep generated demand at 22%.

But the rebels and rock 'n' rollers, who were sure they would never be like their parents' generation as they settled down and got jobs, homes and families, did not forget the waterbed to preserve the memory of their youth and their Great Sexual Revolution.

Gradually the waterbeds died out, and today's waterbeds are similar in name to those of the distant 70's and 80's, when their main feature disappeared - the wave that made it hard to roll over and sleep together, that caused seasickness, that made sleeping uncomfortable and sex fun and unlike anything else.

Because it was sex on the move.

Problem Solution Fit and Product Market Fit

We asked doctors in different countries, can a bed (mattress pad) be functionally useful for falling asleep, sleeping, reducing pain, preventing migraine? We received answers that such beds do not exist, as the bed has no physiological effect on users.

We asked consumers in different countries, in love with their beds and mattresses, how important is the pleasure they get when falling asleep, when awake, when sexsual relationships? They answer very important. Then we asked consumers, if pleasure is multiplied and the bed itself is functionally useful for falling asleep, reducing pain, prevent pain & migraines and many other things, would you be interested in such a bed. The majority responded they would test or purchase such bed.

In the absence of a rocking bed market, the evidence for PSF and PMF is the existence of latent demand for rocking sleep devices, results from rocking bed user testing and surveys.

Proof of PSF (presence of latent demand):

- Rocking in cradles and bassinets, are widely used as a way to reduce anxiety and drift babies into sleep.

- Rocking induces the production of pleasure hormones; smooth monotonous reciprocating movements, including rocking, promote sleep.

- Rocking in rocking chairs, recliners and home swings is a popular method of rest and relaxation for people of all ages, and the market for adult rocking devices is measured in billions of $US.

- Audio-visual stimulation (AVS) is widely used for relaxation, unwinding and falling asleep; combined vestibular stimulation and AVS will be more effective than using them separately.

- The popularity of sex on the move - on waterbeds - has led to a 22% share of waterbeds in the US mattress market.

- Specialty swings are used for sex in motion and are widely available in adult stores.

- AVS has the widest spread in sensual relationships, joint vestibular stimulation and AVS will be more exciting and interesting for partners than using them separately.

Proof of PMF's right direction:

Results of a survey of 45 users of the Bedy rocking bed prototype (45 people from 24 to 62 years old, St. Petersburg, Russia):

- The Bedy rocking bed does not differ in size and shape from a regular bed (45 out of 45).

- Rhythmic rocking on the Bedy rocking bed is a pleasant procedure (36 out of 45).

- Bedy rocking bed users will become accustomed to the rocking procedure (35 out of 45).

- Inability to use the Bedy rocking bed after getting used to the rocking procedure due to business or leisure travel will lead to user dissatisfaction (41 out of 45) (consequence - Bedy rocking bed users will take care of their availability on vacation and business tripsand, will promote the proliferation of Bedy rocking beds).

- Disappearance of Bedy rocking beds from the market will lead to user frustration and dissatisfaction (38 out of 45)

- Rhythmic rocking synchronized with friction (sex on a Bedy rocking bed) will provide new and interesting sensations (assumption 36 out of 45).

- Sensual relationships on a Bedy rocking bed (sex on a moving surface) have great potential (36 out of 45).

Results of a survey of California residents about the price of Bedy rocking beds (19 people, 36-56 years old, employed, middle or upper-middle income):

The price of Bedy's single and double bed rocking beds with the stated features - $3499 $US and $5999 $US, respectively - is acceptable to middle-class California residents (19 out of 19).

Startup Strategy, Stages and Business Model

BEDY startup strategy is aimed at the formation of new market sectors of robotic intelligent rocking beds and rocking devices for short-term daytime sleep for consumer, corporate and medical markets, and leadership of BEDY company in these new market sectors due to the technical, technological and scientific priority of the company, protected by patents for invention, design and technology.

BEDY's products - single and double Bedy rocking beds and short day sleepers - are technically and technologically expected to become the most advanced sleep and sex products with a combination of superior rocking, audio-visual, shape adaptability and temperature control functions to maximize user comfort and provide constant direct and feedback communication between users and the rocking bed or short day sleepers.

The launch of the main products - single and double rocking beds for consumer and corporate markets - is planned in California (USA) for a combination of reasons: large population, high income levels, commitment to the health trend, public interest in innovation in general and in innovation in Sleep Tech and Sex Tech.

The consumer nature of the products will eliminate the need for administrative controls and permitting procedures for the production and sale of Bedy rocking beds.

BEDY startup stages:

0-3 years - investment stage: collection of preliminary orders, no advertising and mass sales of products, scientific and consumer research, development of rocking beds and their components, software development, capital expenditures related to the production of electronic, mechanical and hydraulic components, capital expenditures related to the production, assembly and transportation of products, preparation for the release of products and components. May be - development of a rocking chair recliner, Nap Pod, rocking beds with transformable devices for short

daytime sleep. General character - increase in investment costs with no revenue.

3-4 years - sales start-up stage: start of production of electronic, mechanical and hydraulic components, start of production, assembly and transportation of finished products, start of product sales, product promotion costs, product and business model optimization. General - growth of costs associated with sales and promotion of products with the emergence of sales revenue and gross profit.

4-7 years - project scaling stage: significant increase in costs of production, assembly and transportation of products, significant increase in sales revenue and gross profit due to project scaling, proportional growth of costs for product promotion taking into account optimization of products and business model. General - fixing capital expenditures and all costs of non-current assets, determining break-even points of the project, reaching operating profit.

+ 7 years - operational stage: reaching maximum costs, maximum sales revenue and maximum operating profit, preparation for the next investment cycle related to the development and promotion of new products. General character - obtaining maximum profit from the project.

BEDY startup business model:

Direct supply, supply in cooperation with partners of single and double bed rocking beds with purchased mattresses or without mattresses to private consumers, corporate users - hotels, hospitals, nursing homes, corporations - for consumer and corporate markets.

If the BEDY startup is successful, the product range may be expanded and the characteristics of the rocking beds modified for therapeutic use.

A feature of BEDY company business model is the legal, scientific, technical and technological efforts to form and maintain BEDY company’s monopoly or dominant position in the rocking bed market:

- independent formation of new market sectors;
- prohibiting third parties from copying products;
- direct sales of products to consumers through various sales channels;
- independence in its actions from third parties.

The initial geographic market is California, United States, and the time to market is 2028, after participating in the Consumer Electronics Show in Las Vegas.

Extensive consumer research is planned from 2025-2027 to segment the market and customers, define marketing tools, and identify the most effective sales channels.

In 2026-2027, partnerships are planned with one or more mattress or bedding companies with a network of retail outlets to establish Bedy rocking bed showrooms.

In 2026-2027, Bedy rocking beds are planned to be contracted to supply one or more hotel chains for independent full-cycle and volume consumer testing.

Before the Bedy rocking beds are launched in 2028, an intensive social media advertising campaign is planned, consisting of several dozen funny videos of up to 1 minute in length, in which characters are placed in funny situations and the Bedy rocking bed is given the properties of a human character.

When Bedy rocking beds enter the market in 2028, an important factor will be the loyal attitude of reputable scientists, bloggers, opinion leaders, professional community - American and international organizations of sleep products and sleep medicine: American academy of sleep medicine (AASM), International sleep products association (ISPA), National sleep foundation (NSF), World sleep society (WSS).

The personal experience of using a Bedy rocking bed, whether in a short-term showroom format or a full hotel room format, is a major factor in customer engagement and retention in the sales funnel. The personal experience of vestibular cycling and multi-sensory stimulation cannot be replaced by a salesperson's stories, lying on a fixed mattress, simulation, computer program, modeling or one's own imagination.

The value proposition of the Bedy rocking bed - falling asleep quickly, healthy sleep, pleasant lovemaking, conducted through personal

experience, opinions of scientists and ambassadors, in systemic connection with the uniqueness of the product, will contribute to sales.

When introducing Bedy rocking beds to the market, it will be standard to return the product after a long period of use and disable the rocking functionality with information to the user about changes in their sleep.

Traveling, going on vacation and business trips, Bedy rocking bed users will demand the familiar comfort of rocking, which is impossible to get on a conventional fixed bed, which will positively affect the spread of rocking beds.

Depending on the actual demand, taking into account the feedback from consumers, specific strategy and sales tactics for rocking beds will be built as the project scales across countries and regions.

Introducing the rocking bed to the market of medical beds for the treatment of respiratory disorders in sleep and sleep disorders, and selling them to medical and scientific institutions, is possible after passing the authorization procedures, which vary in length and cost in different countries. The very possibility of bringing the rocking bed to the medical market depends entirely on the results of planned scientific research.

If the results of scientific research on the effectiveness of rocking and the effectiveness of Bedy Active Breathe technology for people suffering from respiratory insufficiency (snoring and sleep apnea) are successful, there will be a significant segment of private users of the rocking bed as a consumer product used for therapeutic purposes.

Current problems:

- Organizational: there is no development team to be created, which will take effort and time, and may eventually lead to longer project phases.
- Technological: labor-intensive tasks of forming algorithms to control the rocking bed, creating customized multi-sensory exposure for different purposes, user interfaces and voice companion.
- Scientific: identification of possible negative short-term and long-term effects of vestibular stimulation and multisensory influence, lack of accurate effectiveness of rocking in different stages of sleep, in respiratory recovery, in counteracting snoring and apnea, including in conjunction with other devices, in waking up, in sensory relationships.
- Legal: risks of challenging patents on inventions and intellectual property.
- Financial: need for external investment to advance the project.
- Economic: low demand for products.
- Technical: breakdowns and failure of rocking bed components.
- Marketing: consumer indifference to the product or lack of PMF.

Critical Issues:

- Identification of significant adverse health effects to rol users due to vestibular stimulation or multisensory exposure.
- Lack of funding at Pre-seed or Seed stages.
- Prohibition of production or sales by rights holders or regulatory authorities.
- Consumer indifference to the product.

Future invention patents relating to the construction and design of a rocking bed, a rocking recliner chair, other rocking Nap Pods, a device and methods for multi-sensory exposure of a falling asleep, sleeping and waking person, couples in sensual relationships, a system and methods for creating a customized environment comfortable for falling asleep, sleeping, waking and sensual relationships should provide BEDY company with leadership in the development of rocking beds and similar products, making it difficult to use or copy its products

Intellectual Property Protection

On 02.07.2024, two provisional patent applications were filed with the United States Patent and Trademark Office (USPTO):

1.Rocking bed and rocking device (Provisional Application 63/666,724).

A variety of rocking bed and furniture rocking bed designs (including a rocking bed for an armchair, a rocking bed for a convertible recliner chair, a rocking bed for a Nap Pod) are described, in which vertical plane-parallel motion is the basic design, two- and three-degree-of-freedom designs have been developed, and designs with a support base equipped with swivel wheels that add three degrees of freedom.

Distinctive features of rocking bed and rocking furniture are the absence of any attachment to the floor, walls or ceiling.

In the description of the rocking bed and rocking furniture various types of power devices are indicated: rotary electric motor, linear electric motor, electrically driven hydraulic pump, electromechanical hydraulic accumulator, electrically driven hydraulic gas accumulator.

The description of the rocking bed and rocking furniture includes various types of movable substrate to which the mattress or seat of the furniture is attached from above: a flat, non-transformable shaped movable substrate, or a transformable shaped movable substrate.

Various mechanical and hydraulic power actuators are described for rocking beds and rocking furniture, and various designs of rocking beds and rocking furniture with different arrangements of power units and power actuators are disclosed.

Designs have been developed in which rocking beds and rocking furniture can be equipped with swiveling electric wheels powered by electric batteries.

The provisional patent application for the rocking bed and rocking furniture is substantial in length (occupying more than 100 pages of textual description, containing more than 50 figures) and is the basis for filing several non-provisional patent applications with the USPTO.

The designs presented in the provisional patent application, “Rocking Bed and Rocking Device,” differ substantially from the designs disclosed in known patents-in-suit and in published patent applications.

Patent searches, regularly conducted by specialized patent companies in the Russian Federation, did not reveal similar designs of the rocking devices on the Internet, in the USA patent database (USPTO), in the Espacenet and Patentscope patent databases.

2.Sensory stimulation device and methods (Provisional Application 63/666,727).

A device based on a rocking bed with synchronized sound and light effects is described, which has the ability to simultaneously affect the four human senses - vestibular, touch, hearing and vision.

It describes a method of forming a conditioned respiratory reflex in a user by means of multisensory influence, a method providing realization of the conditioned respiratory reflex at falling asleep and in sleep (in sleep phases N1, N2, N3), a method of increasing the comfort of a user at falling asleep and reducing the period of falling asleep, a method of increasing the quality of sleep - increasing the period of deep slow sleep N3, a method of stopping respiratory insufficiency (snoring and apnea) in sleep, and a related method of preventing spontaneous awakening in sleep.

The device and methods of synchronous multisensory influence described in the provisional patent application involve all human sensory organs, which can be precisely and dosedly influenced when falling asleep and

during sleep (in a household consumer device it is obviously difficult to precisely influence the sense of smell and taste).

A system and method for forming an individual multisensory environment comfortable for falling asleep, sleeping, waking and sex, including sound effects, visual effects, temperature (touch) effects, vestibular effects is described.

A method of obtaining information about physiological and psycho-emotional parameters of a user preparing to go to sleep using a portable device receiving EEG of the user and sensors receiving physiological parameters of the user, a method of coordinated or synchronous multisensory influence on the user preparing to sleep and falling asleep to reduce the time and increase the comfort of falling asleep is described.

A method of obtaining information about physiological and psycho-emotional parameters of a user before waking up, a method of coordinated or synchronized multisensory influence on a user during waking up for increasing comfort and reducing stress when waking up is described. A method of synchronized multisensory exposure of users to improve sensory relationships is described.

The system and method of forming an individualized multisensory environment described in the provisional patent application involve all human sensory organs that can be precisely influenced before falling asleep, while falling asleep and during sleep - vestibular apparatus, touch, vision and hearing - with the exception of smell and taste.

The provisional patent application “Device and Methods for Synchronized Sensory Stimulation” is the first patent application in the field. The method indicated therein for creating a personalized multi-sensory environment that is comfortable for falling asleep, sleeping, waking and sensory relationships has similar invention patents relating to creating a personalized outdoor environment that lacks exposure to the vestibular apparatus and a rocking bed device.

In addition to the above mentioned provisional patent applications, Ilia Voronin received Russian invention patent No. 2755464 dated 16.09.2021 “Transformable Rocking Mattress”, applied for invention patent No.2020110924 dated 16.03. 2020 “ Rocking mattress” (with flat bed substrate), filed two patent applications with the International Patent Organization (IPO) under the procedure of International Patent Cooperation (PCT) - rocking mattress PCT/RU2021/050035 dated 16.

02.02.2021 and transformable rocking mattress PCT/RU2021/050035 dated 16.02.2021, “genetically related” to the provisional patent application in the USPTO “Rocking Bed and Rocking Device” (Provisional Application 63/666,724) and proving Ilia Voronin's priority.

The transfer of patent applications from provisional to non-provisional status to protect the intellectual property of the project are the first priority activities to be implemented during the external financing of the project.

Work on the rocking bed project was started by Ilia Voronin in Russia in 2019, when technical documentation was developed to create a working mockup of a rocking bed with several linear vertical actuators based on screw - ball screw nut transmission, converting the rotary motion of the screw into the forward motion of the rod, driven by electric motors.

The subsequent technical analysis revealed the difficulties of practical realization of the proposed scheme, which required to formulate a list of technical requirements and a list of necessary consumer properties of the rocking bed.

Since 2020, at the request of Ilia Voronin, specialized organizations in the field of intellectual property have regularly conducted patent research on the availability of patents for the invention of rocking beds, rocking mattresses and other devices with similar functionality to the designs developed by Ilia Voronin. At the same time, information from the Internet, market indicators and consumer properties of rocking bed products were analyzed.

In 2020 patent applications were made to the Federal Service for Intellectual Property of Russia for “Rocking mattress with flat (non-transformable) sleeping bed substrate” (Application №2020110924 from 16.03.2020), and “Rocking mattress with transformable in shape sleeping bed substrate” (Application №2020110922 from 16.03.2020).

In 2021, Ilia Voronin decided to focus on the realization of the rocking bed project. In the same year the Russian Federation patent for invention No. 2755464 for the design of a transformable rocking mattress was obtained. The patent for the invention of the design of a rocking mattress with a flat non-transformable substrate of the sleeping place, which is a special case of a transformable rocking mattress, was not received due to the withdrawal of the patent application due to the irrelevance of the design.

In 2021, two patent applications were sent to the International Patent Organization (IPO) under the procedure of the International Patent Cooperation (PCT) - for a seasleeping mattress PCT/RU2021/050035 dated 16.02.2021 and for a transformable seasleeping mattress

PCT/RU2021/050035 dated 16.02.2021, which were not continued due to the revealed irrelevance of the developed technical solutions.

In 2021 the technical documentation for the rocking bed with hydraulic drive was developed, on its basis at the end of 2022 in St. Petersburg (Russia) a prototype of the rocking bed was assembled from commercially available components and tested, which showed the correctness of the chosen technical direction, the validity of technical requirements and the importance of personal experience of using the rocking bed to promote products on the market.

The results of the user testing are contained in the PSF&PMF section.

During the rocking bed testing process, Bedy Active Breath sleep breathing normalization technology was tested to overcome snoring and obstructive sleep apnea (OSA) without the use of CPAP masks. Subsequently, the Bedy Active Breath technology included methods of forming a conditioned breathing reflex through synchronous multisensory influence realized both in the waking state and in sleep.

The possibility of positive multisensory influence of the rocking bed hardware-software complex on a pair of users in a sensual relationship, as it is produced by audio-visual stimulation (AVS), is a reasonable hypothesis to be confirmed in the future. The absolute majority of subjects expressed the opinion that rhythmic rocking synchronized with frictions will give new positive sensations during sensual relationships, i.e. it can be an interesting and memorable sensual experience.

Ilia Voronin has filed two provisional patent applications with the United States Patent and Trademark Office (USPTO) and is preparing a third application, which combined research and development on various types of designs of rocking bed, rocking chair-recliner and rocking Nap Pod, covering possible design solutions of rocking furniture with hydraulic, mechanical and hybrid drives, related to the device and method of formation of multisensory effects, comfortable for falling asleep, sleeping, waking up and sensual relationships.

The author of the project has developed technical and design documentation of rocking beds with hydraulic, mechanical and hybrid drives, prepared materials on visualization of rocking bed design, made investment memorandum, plans of scientific and consumer research, general work plan for 15 months from the moment of receiving investment in the project.

The Bedy project envisages an investment stage lasting 3 years before the start of sales, during which the optimal models of rocking beds will be developed according to the criteria of price, functionality and reliability, scientific and consumer research on the impact of rocking to sleep, sleep and intimacy, the effectiveness of Bedy Active Breath technology will be conducted, the main consumer groups will be identified and a marketing strategy for bringing the product to the market will be developed.

In order to realize the Bedy project with attracting investments in 2025, it is planned to register the legal entity “BEDY”, which will be the owner of the intellectual property of the project and the recipient of investments in the project.

It is planned to produce two types of rocking beds - single and double, consisting of two single bed units on a single support base that allows them to move synchronously or independently of each other.

The single bed has a flat non-transformable movable substrate moving with two degrees of freedom (plane-parallel vertical movement, rotation relative to the horizontal transverse axis and superposition of the said movement and rotation), to the upper surface of which is attached a flat mattress or mattress of adjustable shape.

Each single bed rocking bed has two independent lifting mechanisms, each of which is driven by its own electric motor. The mechanical drive is chosen as the basic one, with a minimum height of the rocking bed without mattress of 29 cm and a lifting amplitude of 35 cm, ensuring a smooth and comfortable rocking motion. Optionally, a more expensive hybrid drive can be used, which has an lifting amplitude of 71 cm at a similar minimum height.

Rocking beds are powered by electricity from the household power grid, they do not require any maintenance during their operation, their dimensions are the same as those of conventional single and double beds.

The production plan envisions contract manufacturing of independently developed mechanical and electronic components in 2028, with a transition to in-house production in subsequent years.

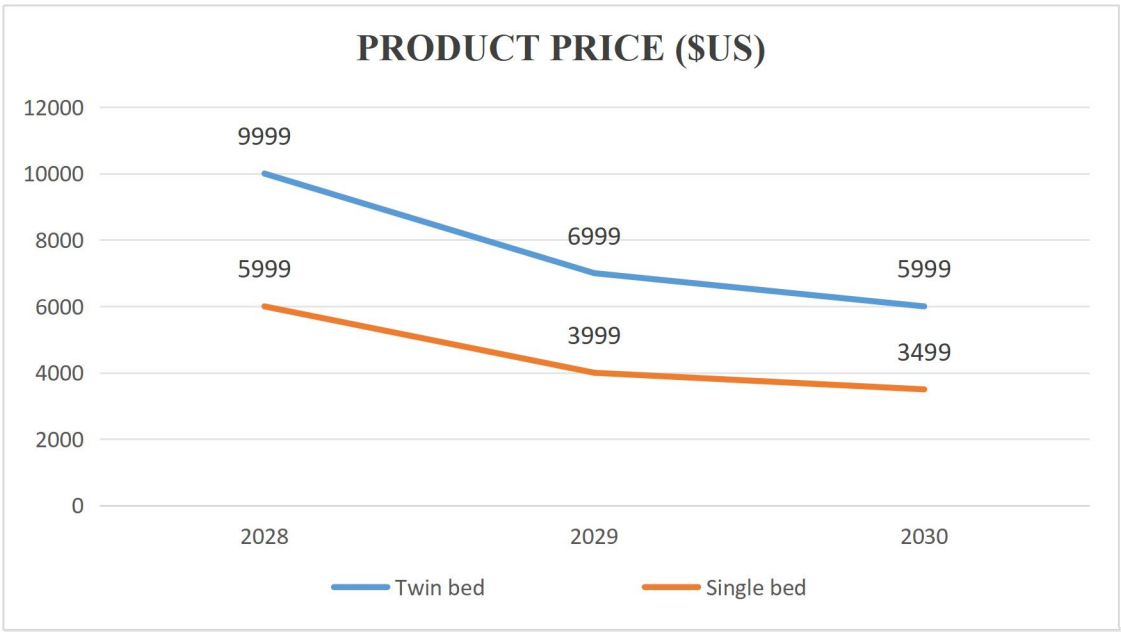
When the project scales up and sales increase, local assembly of products from supplied components in sales regions and local procurement of simple materials are envisaged.

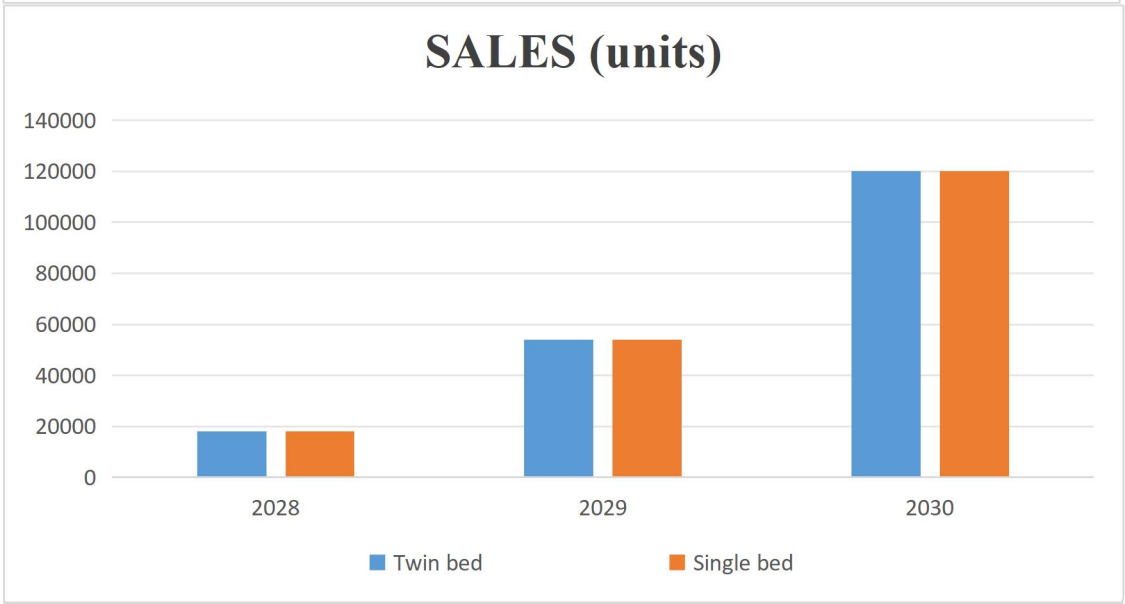
The project envisages sales of rocking beds in 2028 mainly in the state of California (USA) in the amount of 18 thousand one-bedroom and 18 thousand two-bedroom rocking beds, with an increase in sales to 108 thousand units throughout North America, Germany and England, and in 2030 - 240 thousand units worldwide. These sales figures are unsubstantiated and reflect the personal opinion of the project author. After conducting consumer and scientific research, the planned sales volumes will be adjusted.

The calculations assume a reduction in direct costs, logistics costs and overhead costs due to economies of scale and the transition to in-house production of rocking bed components, as well as a reduction in product price from $9999 to $5999 $US for a twin-size rocking bed and from $5999 to $3499 $US for a single-size rocking bed, with annual revenues and profits from 2028 to 2030 increasing from 288/132 M $US to 1140/509 M $US, respectively, due to an increase in the number of sales.

Correctly determining the break-even point and the required sales volume is not informative at the current stage, but it is clear that a monopoly or dominant position of Bedy rocking beds in the market will create positive project economics.

MODEL	Direct costs per unit (US$)	Logistics costs per unit (US$)	Overhead per unit (US$)	Price per unit (US$)	Profit per unit (US$)	Total units	Total income (US$ M)	Total profit (US$ M)
Single (2028)	2077	750	457	5999	2715	18.000	108	48
Twin (2028)	3679	850	809	9999	4661	18.000	180	84
Total for the 2028						36.000	288	132
Single (2029)	1548	600	341	3999	1510	54.000	216	82
Twin (2029)	2832	680	623	6999	2864	54.000	378	154
Total for the 2029						108.000	594	236
Single (2030)	1290	375	284	3499	1550	120.000	420	186
Twin (2030)	2360	425	519	5999	2695	120.000	720	323
Total for the 2030						240.000	1140	509


PRODUCT PRICE ($US)
12000
10000
8000
6000
4000
2000
0
9999
6999
5999
5999
3999
3499
2028
2029
2030
Twin bed
Single bed


SALES (units)
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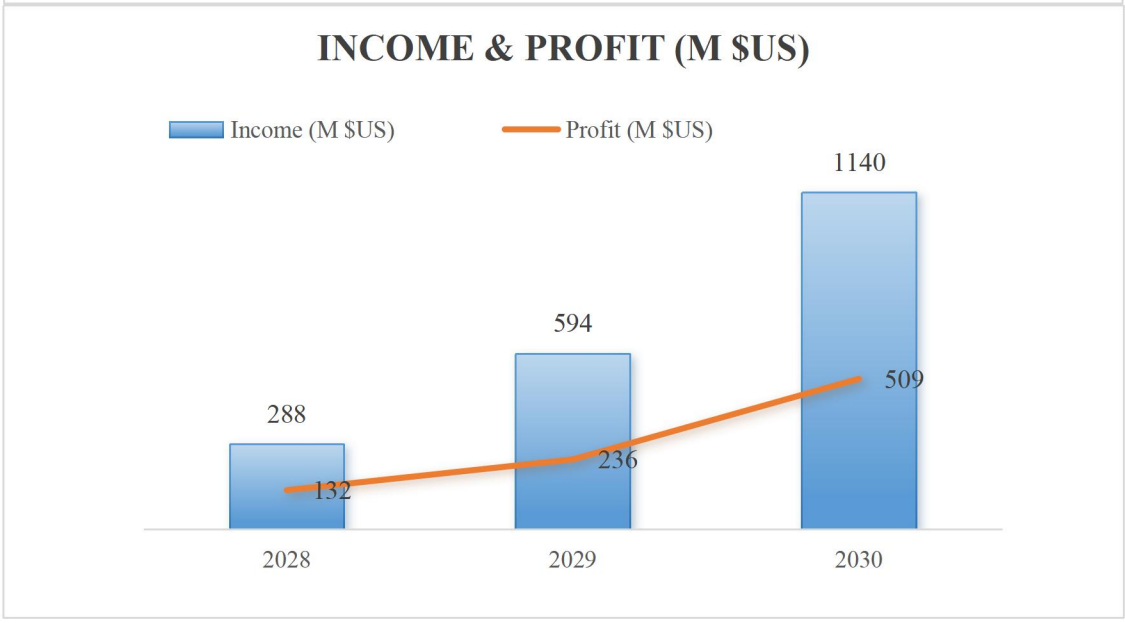
120000
100000
80000
60000
40000
20000
0
2028
2029
2030
Twin bed
Single bed


INCOME & PROFIT (M $US)
Income (M $US)
Profit (M $US)
288
594
1140
132
236
509
2028
2029
2030

Planned research activities

Research directions:

- Determination of patterns of physiological, psychological and emotional state using modern diagnostic methods in real time.

- Determination of quantitative parameters of the influence of rocking and synchronous multisensory influence on rocking to sleep at night and day sleep, on the quality of day and night sleep for users of different ages with different chronic diseases in a wide range of patterns of physiological, psychological and emotional state.

- Quantification of the impact of Bedy Active Breath technology on counteracting breath-holding, snoring, sleep apnea, spontaneous awakenings, and the duration of the deep slow-wave sleep phase N3 in different sleep cycles.

- Quantifying the effects of rocking and synchronized multisensory exposure on improving sleep quality, memory consolidation and increasing cognitive abilities for different categories of users in different physiological, psychological and emotional states.

- Gathering information for compiling effective algorithms of vestibular stimulation and methods of synchronous multisensory influence during falling asleep, during day and night sleep, during waking, during rest and relaxation, during meditation for users of different ages, being in different physiological, psychological and emotional states.

- Identification of negative effects of vestibular stimulation and synchronized multisensory exposure on users' health during falling asleep, sleeping, waking, relaxation and meditation.

- Determination of quantitative parameters of positive and negative effects of rocking and synchronous multisensory influence on sexual relations - libido, duration, satisfaction.

- Drawing up algorithms of rocking and methods of synchronous multisensory influence to improve the quality of sexual relations.

- Identification of negative effects of vestibular stimulation and synchronized multisensory exposure on users' health in sexual relationships.

The research will be funded initially by Bedy's own funds, the research materials will be collected as spin-offs from consumer research, and further by grants and subsidies from universities, research centers and government agencies

The results of scientific and consumer research will determine the value of products for consumers, the potential of products in different markets, the level and boundaries of demand, identify target groups of consumers, help to set the optimal focus and optimal directions for further development of the project, further scientific and consumer research in the development and promotion of rocking beds.

Consumer research

The objectives of consumer research are to obtain the maximum amount of reliable information about the current size and potential of the market (which does not yet exist), about target groups of rocking bed consumers and their preferences, about consumer expectations (for a product that is not yet on the market), about drivers and limiters of demand, about the use of personal experience to organize sales, about the possibilities of word of mouth and viral distribution of products.

Research areas:

Size of demand
Factors affecting demand
Adequacy of value proposition
Adequacy of functionality of rocking beds for different consumer groups
Drivers of demand
Demand Constraints
Target audience segments in relation to sleep and sex
Preferences, needs and motivations of different consumer groups
CustDev and consumer expectations
Preferred functionality for each segment
Factors influencing consumer behavior in the sales funnel
Personal experience and its utilization
Preferred communication channels

The consumer research will be greatly aided by a rocking bed pre-order system and user testing service, through which a full-fledged consumer questionnaire is planned to be conducted after a personal experience with the Bedy rocking bed.

The results of the consumer and scientific research will allow to significantly adjust the plans and determine the actual potential of the project.

Work Plan for 15 months

1.Conversion of provisional patent applications for inventions in the United States Patent and Trademark Office (USPTO) into active patent applications, development of intellectual property management strategy for the project, preparation of patent applications for the design of products under development, preparation of other patent applications in cooperation with a specialized patent organization.

2.Development of a prototype of the software and hardware complex of synchronous multisensory impact, including: rocking bed with a flat mattress and with a mattress of adjustable shape, sound impact device, light impact device, sensors for monitoring the user's breathing, sensors for monitoring the user's physiological parameters, sensors for monitoring the user's mobility in sleep, portable device for monitoring the user's EEG.

3.Manufacturing a batch of prototypes of single and double (10-12 units) rocking beds with sound and light impact devices for consumer research and gathering information for subsequent research.

4.Independent research - collection of information and results of the influence of vestibular stimulation and synchronous multisensory influence on falling asleep, day and night sleep, the effectiveness of Bedy Active Breath technology, using a flat mattress and mattress of adjustable shape for consumer groups of different ages, simultaneously - conducting open and hidden consumer research.

5.Independent research - collection of information and results of influence of vestibular stimulation and synchronous multisensory influence on different aspects of sexual relations of partners, simultaneously - carrying out open and hidden consumer research.

6.Development of own mechanical, hydraulic and electronic component base (can be partially outsourced or performed in cooperation with third-party organizations or purchased from manufacturers).

6.1.Support base.
6.2.Movable substrate.
6.3.Supports of the movable substrate.
6.4.Local noise insulation systems.

6.5.Local vibration isolation systems.
6.6.General noise isolation system.
6.7.Electric motor.
6.8.Electric motor driver.
6.9.Circular encoder.
6.10.High level controller.
6.11.User breath sensor.
6.12.Linear motion sensor.
6.13.Single carriage linear motion axis.
6.14.Linear motion axis with two carriages and a screw.
6.15.Linear motion axis with two carriages and screws.
6.16.Linear axis ball screw assembly.
6.17.Screw-nut assembly of the linear motion axis.
6.18.Cooling system of the linear axis nut
6.19.Electric motor gearbox with brake.
6.20.CVT electric motor gearbox with brake.
6.21.Electric brake driver.
6.22.Mechanical drive with lifting rods.
6.23.Hybrid actuator with hydraulic cylinders.
6.24.Hydraulic shutoff valve.
6.25.Hydraulic shutoff valve driver.
6.26.Hydraulic cylinder with reliable sealing.
6.27.Hydraulic cylinder operating on water.
6.28.Cooling system for the electric motor.
6.29.Linear support system for hydraulic drive.
6.30.Rotation compensation device for the moving substrate.
6.31.Hardware part of the touch screen user interface.
6.32.Voice user interface hardware.
6.33.Hardware integration of an adjustable shape and temperature mattress with a rocking bed.

7.Software development (can be partially outsourced, performed in cooperation with third-party organizations or purchased from manufacturers).

7.1.Data transmission protocol.
7.2.Motor driver software.
7.3.Circular encoder software.
7.4.Linear encoder software.
7.5.Hydraulic valve software.
7.6.Vestibular stimulation algorithms.
7.7.Algorithms for synchronized multisensory stimulation.
7.8.Voice interface software

7.9.Voice assistant software.
7.10.Touch interface software.
7.11.User and EEG sensor information processing.
7.12.Upper level controller software.
7.13.Software integration of adjustable mattress with rocking bed.
7.14.Development of requirements for client compilation, listing, storage and processing of client information.

8.Analysis of tests and studies, development of requirements to the functionality, component base and software of commercial products.

9.Preparing for the main stage of research in cooperation with scientific, medical and educational organizations.

10.Creating a work plan for the next stage of the project (Seed), creating a personnel plan, and determining the cost budget.

In 15 months, a team of 14 core and several guest collaborators for 1.7 million US$ must do:

- Assemble 12 working prototypes of single and double rocking beds with audio-visual stimulation (AVS) devices from standard purchased elements, test them and select the optimal MVP.

- To design the main components of the rocking bed and AVS devices using own and external resources.

- To develop software for rocking bed components, algorithms, controller, interfaces.

- Conduct consumer research, collect information for future research, analyze results and draw valid conclusions.

- Draw conclusions about the effectiveness of vestibular stimulation, synchronized multi-sensory stimulation, Bedy Active Breath technology for different user groups for falling asleep, night and daytime sleep, relaxation and sex.

- Determine the expected demand for the products, their necessary, sufficient and redundant functions, positive and negative factors affecting demand, the main groups of consumers, their expectations and effective communication channels with them.

- To collect the first batch of valid commercial samples of single and double rocking beds with flat and adjustable mattresses.

- Decide whether to work on the project independently or in collaboration with a mattress manufacturer.

Team

BEDY startup was initiated by Ilia Voronin (Israel), who used his own material resources to promote it. Ilia Voronin and Sergey Kablukov (Germany) are co-founders of the BEDY startup.

In 2025, a BEDY company will be registered to implement the project, which will be the owner of the intellectual property and the recipient of investment in the project.

The BEDY startup is currently seeking employees for the positions of:

- Design Engineer with work experience or basic education in robotics,
- Software engineer with experience in customization and programming of electronic components of robotic systems,
- CRO in the field of somnology.
- CRO in the field of sexology.
- CPO with experience in bringing a new product to market.
- CTO.
- Assistant CEO.

The company is planned to grow to ten permanent employees after 6 months of active operations, of which six (CEO, Assistant CEO, two CROs, CTO and CMO) will perform administrative and research activities and the remaining four employees under the CEO, Assistant CEO and CTO will perform engineering activities.

The plan is to grow to 14 employees 12 months after the start of funding by increasing the number of design engineers and software engineers. All employees will be involved in core business processes in the first 15 months of the project.

Temporary staff will be taken on to assist both CROs for technical assistance with material collection and research.

The average monthly salary is planned to be 5600 US$, monthly payroll by the end of the first year of the project is planned to be 67200 US$.

All BEDY employees will receive options to purchase BEDY shares at par value, consisting of fixed and bonus parts. A total of 30% of the shares are to be allocated for this purpose, of which 20% will be fixed, 5% will be allocated by the Board of Directors as bonuses, and 5% will be allocated by Ilia Voronin and Sergey Kablukov.

Further increase in the number of employees depends on the scale of the BEDY company, its evaluation by investors and the estimated sales of rocking beds.

Curriculum vitae Ilia Voronin

Ilia Voronin (born in 1964). In 1981 he entered the Faculty of Physics and Mechanics of the Leningrad Polytechnic Institute, Department of Mechanics and Control Processes, where he graduated in 1987. As a student, in 1986, together with Prof. P.A.Zhilin and his fellow student Igor Golod, he analytically solved the problem of the three-dimensional theory of elasticity about the natural vibrations of a hollow cylinder, for which he created a new analytical method for solving systems of partial differential equations (the method of multiparameter excitations). In the 90s, together with Sergey Kablukov, he co-founded Goodwin, a company engaged in export-import operations. In the noughties he participated in the realization of a large-scale infrastructure project together with Containerships (Finland) - Moby Dick container terminal near St. Petersburg. He was the owner and manager of the ski resort “Eagle Mountain” in the vicinity of St. Petersburg.

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Curriculum vitae Sergey Kablukov

Sergey Kablukov (Germany) age 62. In 1981, he entered the Faculty of Physics and Mechanics of the Leningrad Polytechnic Institute, Department of Nuclear Physics, where he graduated in 1987. He worked as a researcher at the A.F. Ioffe Institute of Physics and Technology, where he was engaged in research and automation of scientific activities. In the 90s, together with Ilya Voronin, he co-founded the company Goodwin and was Commercial Director of Lenta, one of the largest retail chains in Russia. In the 2000s he emigrated to Germany and currently works as Head of Accounting Systems Department at the Ministry of Finance of the Federal Republic of Germany.

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Investments

We are looking for currently US$ 1.7 million investments for 2025 for the pre-seed stage of the Bedy project.