

dodow



Scientific research data



L I V L A B

Health outside the box

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« Dodow was created in order to provide a simple solution for those suffering from sleeping difficulties without leaving any side effects. »

How it compares to existing solutions

Existing solutions

People with sleeping difficulties are often advised to adopt a healthier lifestyle / sleeping habits. Things like relaxing, playing sports, and going to bed at a normal hour. The problem, however, is that these recommendations are often not respected, difficult to implement and require habitual changes that are rarely put into practice.

Aside from being only a temporary solution, long term negative effects of sleeping pills can be felt even with intake as low as 18 pills a year .

In most cases, sleep disorders can be attributed to stress issues (see studies cited below) or more specifically stress management (even micro-stress) issues. People with these disorders are rarely taught how to manage their stress properly in order to stimulate a 'relaxation response' on their own. Relaxation therapy, meditation and yoga that directly address these problems are effective solutions, however, they also require a large investment in time and money.

Dodow provides an all in one solution

We believe Dodow provides its users with an all in one solution without requiring a significant amount of time or financial investment

Our solution combines meditation (concentration on breathing), yoga (slow breathing and focusing on abdominal breathing), and Behaviourial cognitive therapy (paradoxical intention) to maximize the probability of success and allow the user to sleep better and to regain confidence in his or her ability to sleep. After a few months, he or she will probably be able to sleep normally without Dodow.

Dodow's aim to work quickly, effectively and naturally to counteract the effects of stress which are detrimental to sleep. It is also extremely effective from those suffering circadian cycle sleep disorders (jet lag, for example).

Inspiration

A number of cases of insomnia are caused by autonomic nervous system disorders

Several studies have shown correlations between activation of the sympathetic nervous system and difficulties falling asleep.

<http://www.ncbi.nlm.nih.gov/pubmed/11502812?dopt=Abstract>

This study conducted at the University of Pennsylvania reveals the role of an imbalance of the ANS (autonomic nervous system) in causing insomnia, which appears to play a more important role than Circadian rhythm disorders .

« These findings are consistent with a hyperarousal of the central nervous system as opposed to sleep loss, which is usually associated with no change or decrease in cortisol secretion or a circadian disturbance. »

<http://www.ncbi.nlm.nih.gov/pubmed/20673289>

This study, which tested the sleep patterns of 8 insomniacs and 8 normal sleepers, showed that ‘whereas normal sleepers follow the expected progressive autonomic drop, insomniacs show constant sympathetic hyperactivation.

« These data suggest that, whereas normal sleepers follow the expected progressive autonomic drop, constant sympathetic hyperactivation is detected in insomniacs. »

<http://www.ncbi.nlm.nih.gov/pubmed/15310517/>

Another study shows that «good» sleepers subjected to a week of stimulation of the sympathetic nervous system had the same difficulties as insomniacs.

Other studies that support this hypothesis

The hyperarousal model of insomnia: a review of the concept and its evidence

<http://www.ncbi.nlm.nih.gov/pubmed/19481481>

Human physiological models of insomnia

<http://www.ncbi.nlm.nih.gov/pubmed/18346677>

Autonomic Activation in Insomnia: The Case for Acupuncture

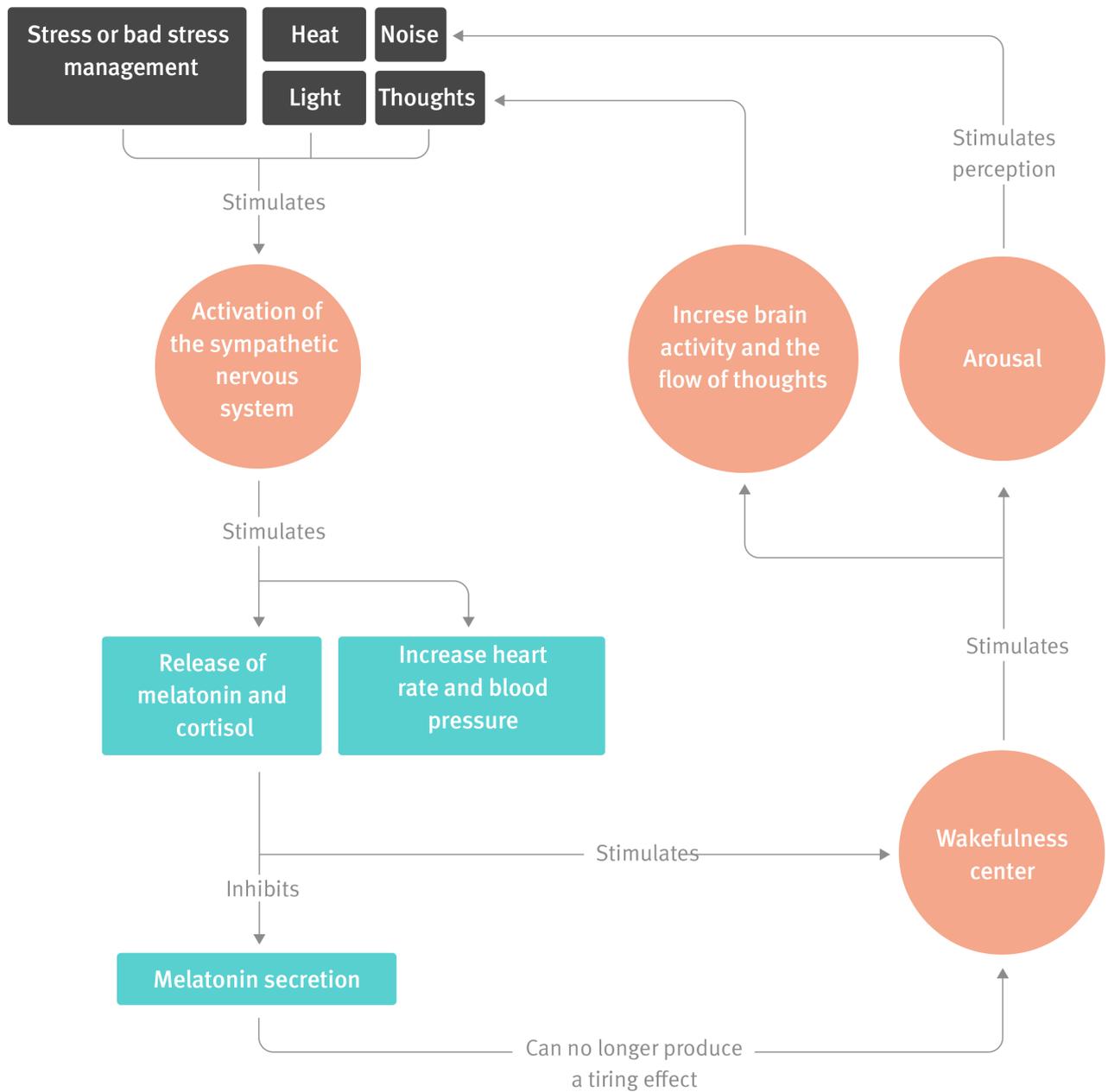
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3041619/>

Putting it in perspective

The autonomic nervous system is the part of the nervous system that manages unconscious activities of the body, like digestion

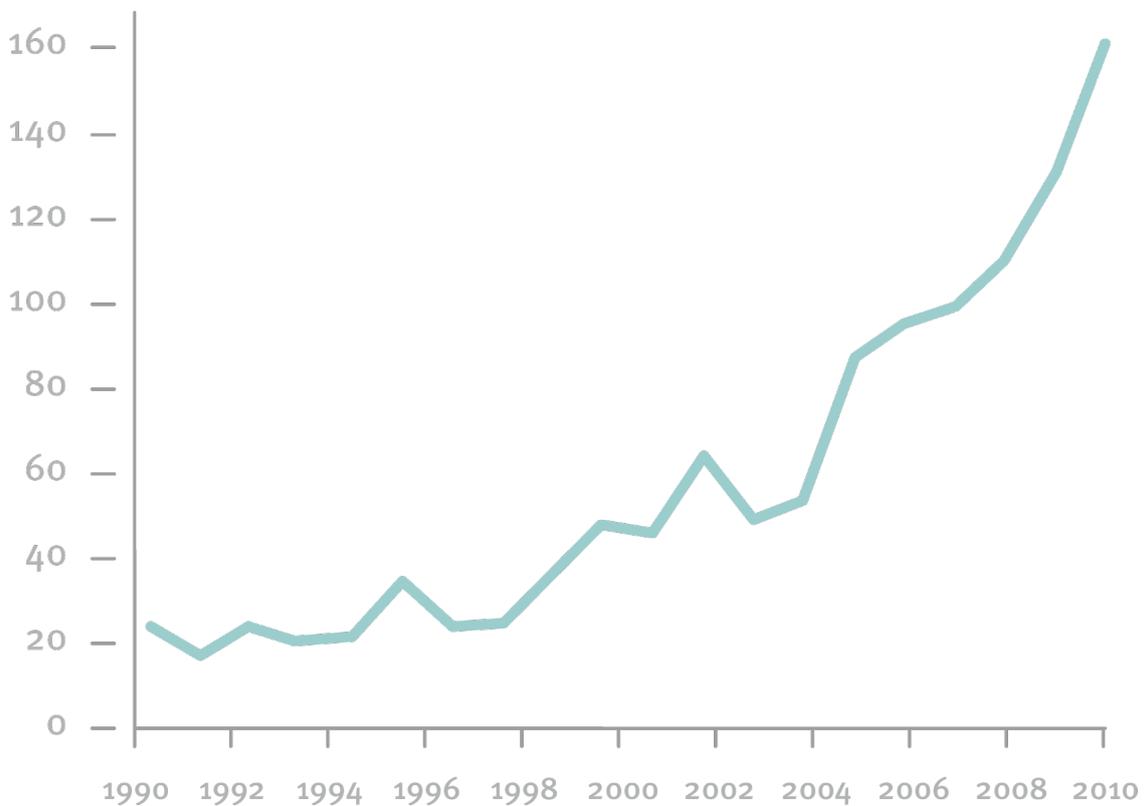
Activation of the sympathetic nervous system (the alert) is a defense mechanism that once allowed humans to survive in a hostile external environment (secretion noradrenaline, increased alertness, muscle contraction, secretion of cortisol to deal with injuries). Certain neurotransmitters activate the sympathetic nervous system to stimulate arousal and vigilance: external stimuli are better perceived to help detect danger. Furthermore, the reaction of these stimuli is stronger than when it is in the parasympathetic (rest and digest state), which is activated. Activating this state was useful in prehistoric constant state danger, but that is much less the case today, especially when it's time to sleep. One could compare an insomniac's problems caused by the autonomic nervous system's to a poorly tuned car alarm that is triggered at the slightest touch.

Description of the mechanism



Synthesis

For those that want to fall asleep quickly, deactivation of the sympathetic nervous system is essential. These studies all recommend relaxation techniques to treat insomnia problems. What methods are most effective and easiest to implement as part of a daily routine? We studied two practices: meditation (focusing on the breath) and yoga (pranayama) which effects are widely known have been the subject of numerous scientific studies.



Number of peer-reviewed publications on meditation as referenced by PubMed

Slow breathing as an ANS regulation tool

Breathing is at the heart of practices like meditation (with object) and Yoga (Pranayama). These practices have been the subject of renewed interest since the 70s, with many studies showing they can result in a decrease in sympathetic activity. While meditation does not impose a specific breathing pattern, focusing on one's breath almost always causes a rapid slowdown of breathing rhythm. In Yoga, the target is to slow down the respiratory rate in order to calm down and likewise accelerate it in order to feel more energetic.

Understanding the influence of slow breathing on the activity of the ANS can be difficult: What is the role of baroreflex stimulation? Hyperpolarisation phenomenon? The fact that breathing is one of the only components of the ANS where humans have control control may have greater meaning.

The following study shows the effect of respiration on sympathetic activity. What's interesting is that the breathing exercise studied is extremely close to Dodow's characteristics: a rate of 6 breaths per minute with an inspiration of 4 seconds and an expiration of 6 seconds.

<http://www.ncbi.nlm.nih.gov/pubmed/19249921>

This study, conducted on forty individuals and inspired by Yoga exercise, shows that a rhythm of 6BPM rate (breaths per minute) with a longer period of exhalation as opposed inhalation led to a sharp decline in sympathetic activity after only 5 minutes of exercise.

« low pace bhastrika pranayama (respiratory rate 6/min) exercise thus shows a strong tendency to improving the autonomic nervous system through enhanced activation of the parasympathetic system. »

«If slow breathing does, in fact, seem to be able to disable the sympathetic system, one may wonder if an optimal breathing rate exists.»

³ Physiology of long pranayamic breathing: neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system

<http://www.ncbi.nlm.nih.gov/pubmed/16624497>

⁴ Meditation and Neuroscience: from basic research to clinical practice (Brabozcz, Delorme, Hahusseau)

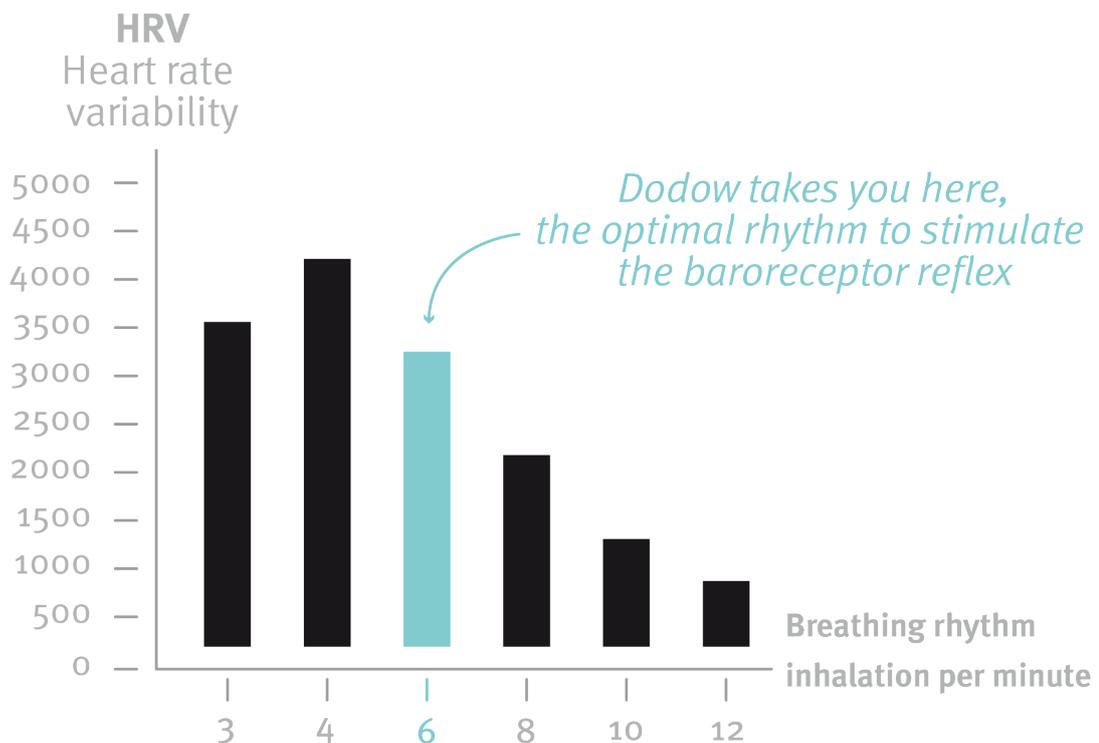
http://sccn.ucsd.edu/~arno/mypapers/delorme_braboszcz_meditation.pdf

An optimal breathing rhythm: 6 breaths per minute

The rate of 6 RPM, found in one of the aforementioned studies, is also used in what is called cardiac coherence exercises, which work to rebalance the ANS.

According to several studies, the rhythm is the rate that maximizes stimulation of the baroreflex. While each organism may be different, the rate of 6 RPM is fairly universal.

«The baroreflex is triggered by the stimulation of baroreceptors. Baroreceptors are located mainly on large vessels, aorta and carotid arteries. When stimulated by distention of the arterial walls, they send a signal that activates and stimulates the vagus nerve and parasympathetic activity.»

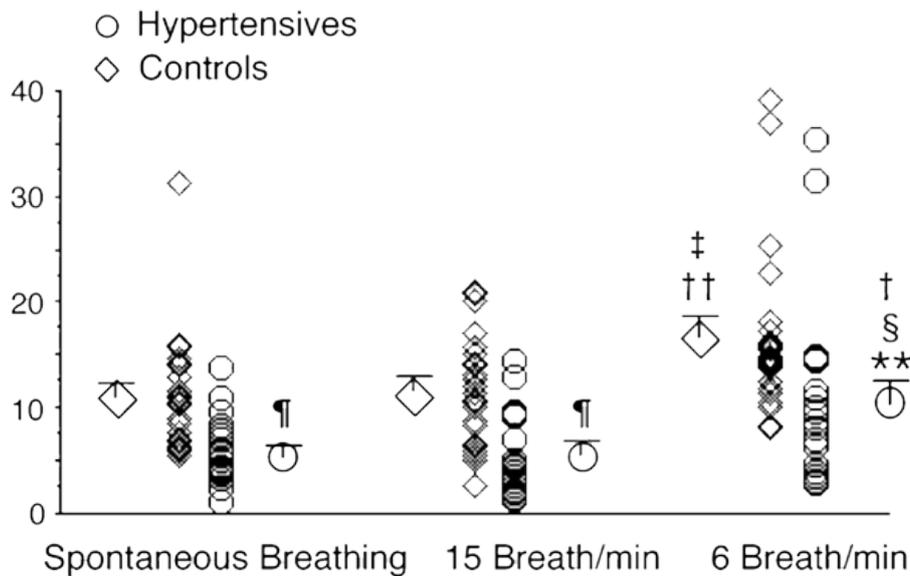


Measure of heart rate variability according to breathing rhythm

http://www.depts.ttu.edu/hess/mccomb/documents/hrv_articles/Specific%20Respiratory%20Rates%20and%20HRV.pdf

The graph shows a leap in HRV (heart rate variability) at 6 breaths per minute rate (the higher the HRV, the smoother the change in cardiac rhythm (as opposed to step change) which is a sign of dominant parasympathetic activity). To make it easier to use, we decided not to go below 6 breaths per minute.

BAROREFLEX SENSITIVITY (ms/mmHg)



Joseph C N et al. Hypertension 2005;46:714-718

<http://hyper.ahajournals.org/content/46/4/714.full>

Table II. Averaged Resonant Frequency Across all Participants, by Diagnosis, Gender, and Age, in Cycles (Breaths/Minute)

Groups	N	Means (Hz)	Std. dev. (Hz)	T-test
Total	56	5.56 (0.0926)	0.41 (0.007)	
Females	37	5.66 (0.0943)	0.43 (0.0072)	$t = 4.07; p < 0.0001$
Males	19	5.21 (0.0868)	0.38 (0.0063)	
Asthma	32	5.55 (0.0925)	0.39 (0.0065)	$t = 0.35; p = 0.73$
Healthy	24	5.50 (0.0916)	0.57 (0.0096)	
Age 40 and less	35	5.54 (0.0923)	0.44 (0.0073)	$t = 0.45; p = 0.61$
Age more then 40	21	5.52 (0.0920)	0.50 (0.0083)	

Characteristics of Resonance in Heart Rate Variability Stimulated by Biofeedback

Evgeny G. Vaschillo,^{1,3} Bronya Vaschillo,¹ and Paul M. Lehrer²

Published online: 13 July 2006

A particular rythm: 40% inhalation, 60% exhalation

After consulting yoga teachers, we decided to use exhale breaths longer than inhale breaths. A longer exhale results in a greater feeling of tiredness.

This phenomenon was explained to us by a sleep physician:

When exhalation is longer than inhalation, more CO₂ is released. When the CO₂ concentration in the blood decreases, the size of cerebral vessels decreases too. This phenomenon, called vasoconstriction, causes a feeling of tiredness.

This effect is particularly useful for a person suffering from a mild circadian disorder (watching television, lying down for a number of hours), and still not feeling tired. Melatonin is normally responsible for the tiredness effect. A cause of these conditions may be because the body isn't producing enough melatonin. The effect produced by a long exhale of breath can serve as an effective substitute.

Concentration can also help

Focusing one's attention on a single «object» (breath in the case of meditation, or noise in the case of the falling rain) can have a relaxing effect and facilitate sleep.

Herbert Benson, a cardiologist and Harvard professor, is one of the pioneers in the study of mind-body relationships. He was interested in studying different ways to rebalance the SNA. One thing he studied was transcendental meditation (that involves repeating phrases (mantra) in ones head).

He synthesized a few criteria to stimulate the relaxation response, with the two main criteria being:

1. A mental object
2. A passive attitude

The mental object is used as a support by the mind. According to Benson, this could be a sound, word, phrase or visual object.

« There should be a constant stimulus e.g., a sound, word, or phrase repeated silently or audibly; fixed gazing at an object is also suitable. The apparent purpose of these procedures is to minimize one's attention to other stimuli »

<http://www.psychosomaticmedicine.org/content/36/2/115.full.pdf>

Try and calm your mind, drifting away from something as stimulating as thought, in order to stimulate a stress reaction and hinder the sympathetic system deactivation

It's like watching a good movie: the waking state is stimulated, making it difficult to sleep. The mind then becomes 'interested' in the images in front of it. The same happens when it's time to sleep, but your mind is distracted by an 'interest'

The repetitive signal coming from the blue light acts as an anchor, replacing interesting thought with something banal

Psychology

While the effect is involuntary, it provides an interesting and additional aide in facilitating sleep.

Some people (often those already overstressed and therefore more likely to suffer from sleep issues) create their own insomnia because they're afraid of not being able to fall asleep. They fear the effects insomnia will have on them the next morning (for an exam or an interview, for example) creating what is known as performance anxiety. This anxiety is a hindrance to sleep.

In the context of insomnia, paradoxical intention is about trying to stay awake in a passive manner without actively trying to fall asleep. With Dodow, the user lies on his or her back, keeping their eyes open while synchronizing their breathing with the light signal. Thus the performance anxiety disappears and sleep becomes easy.

The study highlights the efficacy of paradoxical intention:

<http://www.ncbi.nlm.nih.gov/pubmed/17162987>

« Stimulus control therapy, relaxation training, and cognitive behavior therapy are individually effective therapies in the treatment of chronic insomnia (Standard) and sleep restriction therapy, multicomponent therapy (without cognitive therapy), biofeedback and paradoxical intention are individually effective therapies in the treatment of chronic insomnia »

The blue light

An interview with a sleep physician raised suspicion that blue light may inhibit melatonin secretion, making it detrimental to a good sleep.

Dodow does not disrupt circadian rhythm

Once projected on the ceiling, the light is set to its maximum intensity, which for someone lying in bed, has a very low intensity (less than 1 lux) compared to the high intensity of a computer or television screen (about 60 lux at a distance of 50cm). There's also the additional low exposure time (8 to 20 minutes).

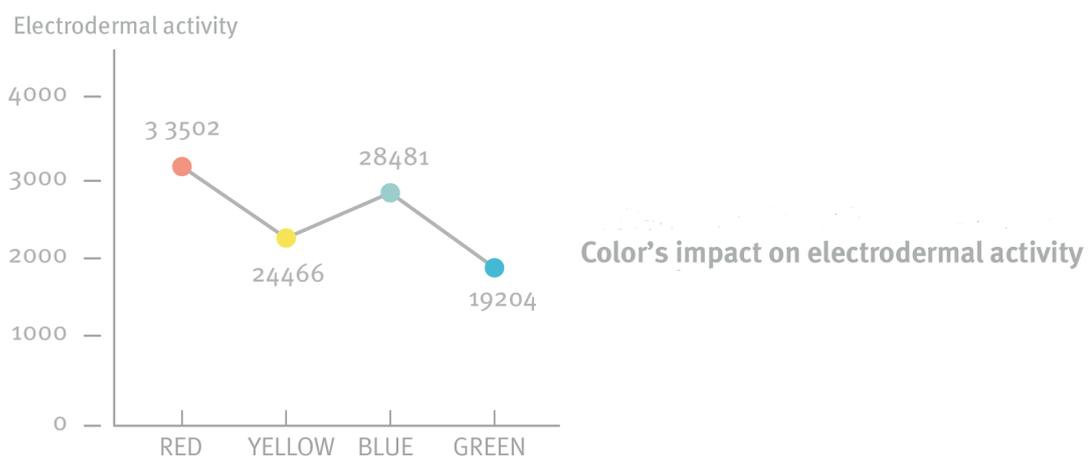
Dodow's impact on the circadian rhythm is almost nothing, so you don't have to worry about it delaying your sleep or offsetting the positive effects described above. The halo of light is actually more color than light.

The blue color was chosen after extensive testing, based on the generally accepted perception that blue has a nice calming affect.

Studies confirm this perception

<http://www.amsciepub.com/doi/abs/10.2466/pms.1974.38.3.763>

This study comparing different colors shows a drop in skin conductance after exposure to blue light



Skin conductance is an objective stress indicator (when the body is stressed, there is a stronger electric current as opposed to when it is relaxed). It's mainly used in lie detector tests.

Why is the exercise difficult to do alone?

1. Finding the right rhythm can be difficult and stressful, potentially hindering the passive attitude required in order to stimulate the relaxation response as described by Benson.
2. The individual having difficulty falling asleep may not have the power to stimulate an effective relaxation response on his or her own. Dodow is easy to ignite, simple to use and placed near the bed, making the process much easier.
3. Individuals with sleeping difficulties may also have difficulty concentrating (partly because of the sympathetic activation system) and tend to get lost in their thoughts in the middle of the exercise. With Dodow, all you need is 8 minutes and there is always an indicator when an exercise needs to be completed.
4. It's very difficult to achieve the optimal rate of 6 breaths per minute on one's own. Dodow brings the user to this rate gradually, starting at a rate of 11 breaths per minute.
5. By projecting a light on the ceiling, Dodow materializes a mental object, allowing the user to let go from his or her thoughts

Conclusion

Dodow tackles one of the main obstacles to achieving a sound sleep. It is easy to use, harmless, non-addictive, affordable and can be used at any time of night. Our goal is to democratize its use and create a solution referenced by physicians.

