

[Announcer:](#) Bulletproof Radio. A state of high performance.

[Dave:](#) You're listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is that I just got off 10 hours of flying, and well, if you can't hear it, my voice is a little dry. But I'm going to do this episode anyway because it is going to be awesome, and it's one I've been wanting to do for quite a while to share something new with you guys. But that's not really the cool fact of the day, I'm just explaining why I sound a little different. The real cool fact of the day is that only 21% of people in the U.S. get the recommended seven to eight hours of sleep each night, not that you really need to get that much sleep necessarily. But in contrast, people in France sleep an average of 8.83 hours per day, which is the longest country for sleep in the developed world.

[Dave:](#) Now, there are studies that show if you sleep more than eight hours a night, you're more likely to die from all causes of mortality. So, France, come on guys. Sleep a little bit less, maybe lay off the wine a little bit, and you'll be okay. However, it turns out some people can survive on much less. About one to three percent of the population are short sleepers who need less than six hours a night. In the animal kingdom, a brown bat needs almost 20 hours a day, and a giraffe, which is obviously one of my spirit animals, only needs 1.9 hours of sleep a day. And this stuff came from Michael Breus, the guy who wrote *The Power of When*, and is also a former guest on Bulletproof Radio.

[Dave:](#) But it's pretty neat to just look at the diversity of sleep that's going out there, and today's episode, as you might've guessed, has something to do with giraffes. Okay, maybe not. It has something to do with sleep because the guy who's coming on today wants you to sleep better, and he's done insane amounts of research and even developed technology based on sound, light, temperature, and relaxation to help you do just that. He's known as Dr. Snooze, although his actual name is Dan Gartenberg. He's the co-founder and CEO of Sonic Sleep, and an Adjunct Assistant Professor at Penn State University, with a PhD in cognitive psychology and an expertise in sleep, A.I. and preventative health. And I've known Dan for several years; he's been granted multiple patents and developed a whole bunch of sleep tech, and you might've read about him in national magazines or seen him on the Today Show. And today, we're going to talk about Sonic Sleep and the technology behind getting better sleep. If you read *Game Changers*, you noticed that I mentioned Sonic Sleep as one of the sleep hacks that I recommend. Dan, welcome to the show.

[Dan:](#) Dave, great to be here.

[Dave:](#) Now, when I said that I wrote about Sonic Sleep in *Game Changers*, your eyes rolled. Am I remembering right, that I put it in my manuscript but it didn't make it all the way through my final edits? Did something happen there?

[Dan:](#) All is forgiven, no worries.

[Dave:](#) Man, all right.

[Dan:](#) We're getting into it now.

[Dave:](#) In *Game Changers*, the book, that's a concentration of all of the many different podcasts. I wrote about the importance of sleep because so many guests who have been on the show who aren't sleep experts said it mattered a lot. And to start, here's my latest sleep hacks you don't know about. When you're in a hotel, you can run Sonic Sleep, and it gets you more, basically more REM sleep or more deep sleep, and it blocks out bad sounds. And full disclosure, I invested in Sonic Sleep a while ago, and so I've been following this thing. All right, when's the time to share this? And you're waiting for the new app. So, we're going to talk a little bit about the app, but this is just more about the sleep stuff that I haven't talked about before on Bulletproof Radio. We all know maybe if it's darker that's going to be better, stuff like that, but we're going to go a little bit deeper. So, Dan, I'm just stoked you finally had the time to come on as a busy startup entrepreneur.

[Dan:](#) I'm so excited to do this.

[Dave:](#) All right. I wrote a post, oh geez, eight years ago, about this thing called the Zeo, and the Zeo was the first EEG sleep monitor. It was this dumb-looking headband, and Ben, the guy who started it, is still a friend. And I'd wear this thing, and Lana, my wife, would just roll her eyes and be like, "Oh my God, you're doing it again." And I got sleep data that led me to write the hacks about raw honey or brain octane or collagen before sleep, and taping over LEDs that are now very common, like every sleep hack talks about that stuff. But I was measuring this way back in the day, and I said, "Here's how you change your sleep score." Because everyone says, "Oh yeah, if you sleep eight hours, you get more points."

[Dave:](#) I'm like, I didn't want to sleep eight hours. I only had six hours. I just wanted four hours of deep sleep and two hours of REM sleep, not that I've ever gotten that good. So, was I right or was I wrong in terms of looking at efficiency versus quantity? And you're the pro, and tell me when I'm wrong. I want to hear it.

[Dan:](#) So, I mean, I think at the end of the day it's quantity and quality.

[Dave:](#) So, you're telling me I'm wrong, Dan?

[Dan:](#) No, I think you're right, and it's complicated.

[Dave:](#) There you go. That's the real answer.

[Dan:](#) I mean, I actually was partly inspired by the z score, they called it the ZQ score, way back eight years ago. I think your thing, if I remember correctly, was the Zeo Force Multiplier.

[Dave:](#) Yeah.

[Dan:](#) Kind of a cool name. For actually changing that value that you get when you wake up for how well you slept based on the sleep that you actually need.

[Dave:](#) For the sleep that you just had. If I only had five hours, tell me I did a good job or a bad job. I know I should've had more, but that's my life sometimes.

[Dan:](#) Yeah. So, I mean, quantity is a big part, but as you've talked about before, quality is such an important thing. And one thing that makes this question really complicated is that while the National Academy of Sleep Medicine says that people need at least seven hours on a regular basis, and as much as nine-

[Dave:](#) If they're sick. I'm sorry, I just had to say that.

[Dan:](#) No, that's exactly what I'm saying. I'm going there.

[Dave:](#) Oh sorry, I stole your thunder.

[Dan:](#) If you're sick, I mean, you need more sleep. If you're going through a lot of personal challenges.

[Dave:](#) Yeah.

[Dan:](#) This isn't just a sleep need based on an individual, this is actually intraindividual. And I actually deal with this sometimes when I'm really having a stressful day at work. I know that maybe I need to get a little extra sleep that night. And that also being said, if I can align my circadian rhythm, and I think you've really delved deeply into this, you can get better quality of sleep so that you can get by on less. And there's many other ways to try to, you know, hack your sleep quality to actually be able to get by on less sleep.

[Dave:](#) All right, so if it's possible to get by on less sleep, tell me what you think. Two nights ago, thank you for huge amounts of wind that screwed up my flight, so it took hours longer than planned. I only slept three and a half hours. That's considered a crap night's sleep, but according to my Oura Ring, I got exactly one hour of REM sleep and 42 minutes of deep sleep in three and a half hours. How'd I do?

[Dan:](#) I mean, so that would be a healthy amount of sleep. I mean, that's more deep sleep for your age group than if you had slept the whole night. So, this is the thing.

[Dave:](#) See? See? That's what I'm talking about, right?

[Dan:](#) But so there's the Dave Asprey sleep need, and then there's the general population sleep need. And you know, not everyone is doing all the things that you're doing to optimize, so I'm just trying to speak to multiple. And this is why sleep is so complicated, because it's a very personalized thing. And I think why a lot of these companies like Zeo, Hello I.S., various companies in the sleep hardware space have failed is because the science of sleep is ... it's hard to give generic feedback because for example, if you are someone with insomnia, I might give almost the exact opposite feedback as someone that's just trying to optimize this like you're trying to do.

[Dave:](#) Oh, yeah.

[Dan:](#) And I think finally we're at a place with the technology where these hardware companies, I.E. Apple, Fitbit, are finally opening up their technology to third party developers that is enabling people like me and my research lab at Penn State to do the hard science that's involved to actually delivering people these personalized sleep improvement solutions.

[Dave:](#) All right, Dan. I've got to tell you this. You may actually save more human lives than almost anyone else alive, and here's my math. Okay, if your tech, and there's a bunch of other sleep researchers working on this similar problem and from all sorts of different angles. If you were to take the however many billion people there are, what, about six, seven billion floating around? Something like that? So, let's just save seven billion people two hours of sleep at night so that they wake up, they have less health problems than they do with their crappy sleep now, and we all get two hours of more serving our communities, being parents, reading, playing Xbox, it doesn't matter. Whatever brings you joy, as long as you're getting that quality sleep. If you look at two hours times six billion people, you know how many human lifetimes that is? I'm serious.

[Dan:](#) Trust me, this is what has inspired me in this for 10 years, that very thought process.

[Dave:](#) It's like a Nobel Prize. I mean, seriously, it's that important.

[Dan:](#) Yeah.

[Dave:](#) Okay.

[Dan:](#) And I think the Nobel Prize a year or two ago was for some research on circadian rhythms.

[Dave:](#) Absolutely was, yeah. All right, well maybe when you just realize okay, here's the personalized algorithms required basic monitoring. Do these 10 things, and you'll get more deep sleep than most people get in a night in three and a half hours. By the way, that probably wasn't enough time for my glymphatic system to wash my brain toxins, and if I did that every night, I would probably get Alzheimer's disease or something bad would happen over time. So, unquestionably, that was a bad practice. It's just, I only had three and a half hours. That was my life that day, but you know I made the most of it, and that's the real perspective here.

[Dan:](#) Yeah, might as well get the most out of the sleep you're getting, right?

[Dave:](#) Yeah.

[Dan:](#) And this question of, you just brought up Alzheimer's, this is actually one of the big focuses that we're taking with this research because there's more and more evidence. Well, sleep is related to basically every chronic health illness, but especially cancer, diabetes, hypertension, stroke. But there's especially recent evidence relating it to Alzheimer's disease, and slow wave sleep in particular having to do with cleaning out beta amyloid plaques, basically, is the simple way of putting it. And so that's kind of the

focus of my research, is on regenerative slow wave sleep or deep sleep, and how that relates to both cognitive functioning. And recently an angle that we're taking, some of the grants that we have with the National Institute of Aging is to actually use sleep as a way to mitigate conversion to Alzheimer's disease, which is expected to triple in the next 20 years. So ...

[Dave:](#) And my new book on anti-aging that isn't out yet, but for all of you listening, I don't know if I've talked about it before. I am in the late stages, I just finished the first draft of a book that's been in my head for at least five years, and this is the stuff I'm actually doing to live to at least 180 or die trying. And it looks like Alzheimer's is one of the big four things that's probably going to take you out unless you do something about it. And it comes from food, it comes environment, it comes from toxins, and it comes from sleep, which is why I've had a variety of sleep experts on for a long time and why I decided I wanted to get behind Dan's work, because it's pretty heavy duty stuff.

[Dave:](#) Now, tell me about sleep age, since we just hit on Alzheimer's, which is considered a disease of aging instead of a disease of inflammation. And sleep age, do you know your sleep age? What is that?

[Dan:](#) So, this is something that we've tried to distill. The cool thing that inspired me about the ZQ score is that it was a value that represented what you did during the day or over the night that you could latch onto to make sense of how you slept. Then again, what does it actually mean when I have a ZQ score of 90? You got into what that means a little bit, but it's pretty opaque.

[Dave:](#) Just to be really clear, Zeo, unless you're a super fan and you buy one on eBay, Zeo went out of business because they were too early. So, we're talking about the first major sleep tech out here that used EEG for you, but you can do similar types of things with an Oura Ring, and you can even use the algorithms that you've got. Dan, you're actually taking data from the Oura ring and then applying additional sleep research to that.

[Dan:](#) That's exactly right. We're trying to ...

[Dave:](#) Keep going. I just realized if someone's listening trying to buy a Zeo right now, they'd be pissed. So, don't worry about buying a Zeo. You're going to want an Oura Ring if you like what we're talking about here. But continue on your path.

[Dan:](#) Yeah, I mean just the headset form factor is one of those things that it sometimes does more harm than good, I think, for most people, and-

[Dave:](#) Yeah. If you like the other things you do in bed, I can tell you there's nothing sexier than a big old head set with a couple wires coming off it. Maybe if you're into borg sex or something, but-

[Dan:](#) Yeah. The sleep partner might not be too happy about that. Borg sex, that's hilarious.

[Dave:](#) Good thing my wife likes Star Trek. But Philips has a dream headset, so there are EEG headsets you can get now. I've got one of those. They're just bigger and just they don't match your Victoria's Secret outfit. So, in my mind, it's got to be sort of low stress and it's got to provide really clean data.

[Dan:](#) Exactly, and I actually published a paper personally in Personal and Ubiquitous Computing in grad school all about, how do we get this data noninvasively? And I love the ring, the Oura Ring is a great form factor and the battery is great. We also develop our algorithm on Apple Watch.

[Dave:](#) Oh, cool.

[Dan:](#) And we've shown that the sensor of that is, the sensors are basically just as accurate between Oura and the Apple Watch.

[Dave:](#) Is it actually Sonic Sleep itself, or is it just some other way of working with what you're doing.

[Dan:](#) No, yeah. So, Sonic Sleep, we're about to ... we have our app right now on IOS and Android, and in about a month we're rolling it out on Apple Watch.

[Dave:](#) Oh, beautiful.

[Dan:](#) And then we're trying to ... yeah. And then we're trying to get all the other wearables. My whole thing is, I like a lot of the wearables, and we're just trying to integrate with the best ones.

[Dave:](#) And the idea there is you can have university grade, super detailed sleep analysis that goes along with the wellness score and the recovery score, and all the other good stuff that comes with each of those different devices. And the future that I predicted actually in a blue book that I wrote for investors about 10 years ago. I'm like, "Look, there will be a marketplace for ideas. And if you like Dan Gartenberg's sleep professor stuff and you want him to look at your data and tell you what to do, then okay, great. And if you like Dave Asprey's biohacker stuff and you want me to look at your data and tell you what to do, great." And it just becomes a marketplace of ideas and you're like, "Maybe I'll try both and see which ones work better." And, "Gee, Dan kicked Dave's ass because he's actually a professor of sleep and Dave's a hacker."

[Dave:](#) Okay, that's all good, but this needs to happen, and you're one of the current examples of this really happening instead of kind of the first wave of this that was maybe too early, they came out at Quantified Self a while back.

[Dan:](#) Yeah, and I remember back in 2011 I think it was, in one of those first Quantified Self conferences, that we were talking about-

[Dave:](#) I have the poster from that hanging downstairs.

[Dan:](#) Yeah, I still have that poster, too. It's the blue one with the little circle. It's a cool poster, right?

[Dave:](#) Yeah, totally.

[Dan:](#) That was a great conference, and I think you were talking about HRV even back then.

[Dave:](#) Yeah, and in fact, I think I put HRV in the sphere of biohacking. Before then, it was just a weird meditation thing or a hospital grade thing.

[Dan:](#) And you know, we all thought then that these new devices were going to change healthcare. At that conference, I remember I particular, it felt very exciting.

[Dave:](#) Yeah.

[Dan:](#) And that-

[Dave:](#) We were right, we were all just too eager in terms of the timeline.

[Dan:](#) Yeah. I guess we were a little presumptuous and maybe a little naïve, but I think now is actually finally the time.

[Dave:](#) Yeah.

[Dan:](#) But you know, we kind of went on a circuitous route there.

[Dave:](#) To sleep age, right?

[Dan:](#) But back to sleep age, we've kind of conceptualized the ZQ score as an age that maps onto what, for example, a 20-year-old would be getting. So, for example, deep sleep is something that generally decreases with age. So, a 20-year-old usually spends about 20% of the night in deep sleep, and then if you look at the population stats, by the time you're 80 it goes down to 7.5%. So, we measure various aspects of sleep quality, map it onto the population statistics, and actually tell you where you're lining up compared to other people in the United States.

[Dave:](#) And to the point now, in my mid 40s, if I don't get at least an hour and a half of deep and an hour and a half of REM, can I consider that a sleep fail? And there are nights where I get two hours of one or the other, and quite often two of each, even though I'm sleeping six, six and a half hours. And this was not happening for me even two years ago, so a lot of different things have worked to make it happen, but I don't call it sleep age because I don't have your algorithmic purity. But I do realize I'm sleeping like a 20-year-old, which kind of makes me feel good.

[Dan:](#) If you're getting an hour and a half of deep sleep and REM a night, that is very good, almost better than a 20-year-old.

[Dave:](#) Especially in less than eight hours. It's unbelievable, but I do all of the stuff in my books, and I think the stem cells, the whole-body stem cell makeover, I did an episode with Marcella [Madera] about that. I think that getting stem cells in my brain really did give me a younger brain, because my sleep quality shifted.

[Dan:](#) Yeah, you were saying that, I was listening to that podcast actually, that you think you actually shifted your circadian rhythm a little bit, too.

[Dave:](#) Yeah, that's really inconvenient. I woke up this morning at 6:30. It's still kind of dark at 6:30, it's horrible. I mean, I stay up late and I write my books, and I'm losing my writing time between 11:00 p.m. and 2:00 a.m. is the sweet spot for really creativity for me, and now I'm like, "Oh, I guess I could go to bed at 10:30." Which it's been an impossibility for probably 40 years of my life to do that, and now it's like, ah, I could go to sleep. And then I actually sleep really well, and yeah, if I go to sleep by 11:30 I do get at least an extra 20 minutes of deep sleep from doing that, and it's pissing me off.

[Dan:](#) Interesting.

[Dave:](#) Yeah.

[Dan:](#) Yeah, I mean, I think what you're hitting on here is a topic that I find fascinating. Based on your circadian rhythm, there's probably a better time in the day to do different activities.

[Dave:](#) Oh yeah.

[Dan:](#) And that's something we're working towards in some of our algorithm work, is ... and this fluctuates. You've talked about it in some of your books with the different types of animals for different types of sleepers.

[Dave:](#) Yeah, that's Michael Breus, actually. Those aren't my books, that's *The Power of When*.

[Dan:](#) Oh, okay.

[Dave:](#) I quoted him earlier.

[Dan:](#) Oh, right, right, right.

[Dave:](#) Yeah, but that work, it's totally real. There's a good time of day for sex, there's a good time of day for board meetings, and it's a big problem if your wife's time of day for sex is early morning and your time of day for sex is 10:00 at night. And you're like, "Well, maybe we have to meet in the middle somewhere. It's time for that lunch meeting." But-

[Dan:](#) That's an interesting thing, is what if you could say the best time that's convenient for the relationship?

[Dave:](#) Well, he does that in his book. He explains it.

[Dan:](#) Oh, really.

[Dave:](#) It was mind-blowing stuff because you're like, "Oh, and if you want to ask for a raise, maybe you shouldn't do it when your boss is completely like a curmudgeon because they had to come into work at 8:00 A.M. and they're not a morning person." You're like, "Maybe we'll just do it a little bit later." If you're a salesperson, this matters so much. I'm super stoked on it, but tell me what you've learned. What are you learning in the lab about this?

[Dan:](#) Yeah.

[Dave:](#) Because Michael did it as a clinician, you're doing it as a university researcher. You're going to get different results.

[Dan:](#) Yeah. So, let me just tell you kind of the way that I think about this with time of day and what sleep is actually doing. So, the theory I subscribe to and a lot of people in the research do as well, for one of the main reasons, there's many reasons, but one of the main reasons why we sleep is something called the synaptic homeostasis hypothesis. And so Giulio Tononi kind of coined this theory, and it's basically that over the course of the day, the activation of your neurons gradually increases. And I think that part of why you have more creativity towards the night time is because you have an overall higher neuro activation. Your neurons are kind of firing at a higher level, basically. You could think about it like that.

[Dan:](#) And the main function of sleep, according to this theory, is that during deep sleep you down regulate all those relevant connections that you made during the day such that the relevant things to your survival rise to the top. So, you know, it used to be, you know, don't go to that part of the forest because the lions are over there. Now, it's like, what did so and so say about me at the office? Or something like that. And then that happens in deep sleep, you down regulate. And then in REM, you replay all the relevant things to your survival and then integrate that into your personality and your long-term memory, basically.

[Dave:](#) That is pretty epic to understand, and what do I do with that? Even just sleep age. Okay, so someone figures, "I have an old sleep age, I have a young sleep age," or they look at the whole data set you just had there, what do you do with it?

[Dan:](#) So, this is the main thing that has also been at the front of our minds, is all these devices, like Fitbit is like oh, you got so and so deep sleep. What do you do with that information? There's nothing that's that actionable about that. And so we're not just trying to track, but we're actually trying to enhance. And I think that's really where the field ought to go, so by more accurately measuring sleep, based on your sleep stage, there's ways of actually enhancing your, for example, deep sleep in real time while you're sleeping through sound or temperature stimulation.

[Dave:](#) And that's something that I've been using your app to do, which is-

[Dan:](#) Yeah, so ...

[Dave:](#) Which is kind of cool.

[Dan:](#) Yeah. So, there's two components of sound that we can think about here. A really low hanging fruit way to improve your sleep quality is to block out noise pollution.

[Dave:](#) Yeah.

[Dan:](#) So, this is something that, you know ... and it's actually a socioeconomic issue, too.

[Dave:](#) Oh yeah.

[Dan:](#) Where there's some recent research on this that's really kind of depressing a little bit. But basically, urban environments that are louder and sometimes poorer, the people in those environments often get worse sleep. And part of the reason for that is, you ... and this is something that was very surprising to me when I was doing this research. Sounds wake up your brain throughout the night all the time without conscious awareness of it, of this happening. So, when people come into our laboratory environment, we hook them up to the best wearables, we connect them to polysomnography, and we work with this fabulous professor at Penn State, his name is Orfeu Buxton, to conduct these trials. And then we have the EEG data giving us truth.

[Dan:](#) While we're looking at that data, we have a postdoc, Margeaux Schade, who actually, her specialty is the understanding of how sleep impacts pain perception, and that's another whole thing we can talk about. But she'll look at the brain waves and then systematically administer sounds to people. And she'll literally play hundreds of these sounds to people throughout the night louder than how I'm speaking to you right now, and people have absolutely no idea that the sounds were played, yet it's disrupting their sleeps, basically.

[Dan:](#) So, step one is mitigate that impact with what we call is an acoustic cushion. So, we basically measure the sound in the room and then adaptively ramp up the sound in order to mitigate the impact of noise pollution. So, that's step one.

[Dave:](#) For me, in hotels I've really noticed a difference from just doing that with Sonic Sleep. Because at home, the only noise pollution I had last night, I live on a small organic farm, a woodpecker lands on our chimney. And they like to peck on the chimney because it resonates, so they make a lot of noise to attract a mate. That's why I woke up at 6:30 this morning. I just wish that woodpecker would find a mate and stop doing that, but you know, okay, that's not normal. In hotels, it's elevators, it's people in the hallway, and it's just all the machinery in hotels that I find I get worse sleep just because of that. And when I turn on the acoustic cushion stuff, just on the phone next to my bed, in airplane mode, I do sleep better.

[Dan:](#) And there might be another process that comes to mind for why that also might be, is there's a really interesting effect in the sleep literature called the first night effect. And basically, whenever someone goes to a new sleep environment, almost always they naturally have a little worse sleep quality. It's because your fight or flight response system is naturally a little bit elevated when you're in a new environment, and part of what we're doing with sound is that we're building this association.

[Dave:](#) By the way, it's ironic we have a siren in the background when we're talking about noise pollution. Anyway, keep going.

[Dan:](#) So, I'm kind of such a ... I'll self-inflict on my biohacking I think a little bit more than you, and I actually recently just moved to a very noisy apartment in New York City to try to demonstrate that I could actually resolve this problem.

[Dave:](#) Without \$20 million, you're not living in New York City in a quiet apartment. Sorry, it's just noisy everywhere.

[Dan:](#) Yes. So, I've actually tried to hack this in my own environment.

[Dave:](#) Is it working?

[Dan:](#) So, I have a kind of crazy setup. So, I have surround sound speakers connected around my window, and then also by my bed. And so kind of the whole house has this sound cushion to it.

[Dave:](#) Are you sleeping by yourself, I'm assuming?

[Dan:](#) Yeah. [crosstalk 00:27:36]

[Dave:](#) Yeah, my sleep hacking takes a hit when I sleep with Lana, okay?

[Dan:](#) Yeah, so I'm recently single, so I can really dive into some of this stuff.

[Dave:](#) Yeah, it's actually a gift because you sleep way better when you have that flexibility.

[Dan:](#) And the bed partner is a really other ... so, I do sleep consultations with people, too, and that's another thing that I was surprised by, is [inaudible] and the bedroom partner are oftentimes major contributors to poor sleep quality. And I have an article called Split blankets, not beds, all about trying to mitigate that relationship.

[Dave:](#) Oh man, I love it. I'll link to that on Twitter or something. Lana and I switched about four years ago to split blankets.

[Dan:](#) Yeah.

[Dave:](#) It makes a big difference. And plus, I like way firmer than she does, and sleep surface I'm sure is a variable. So, I oftentimes do the paleo style of sleeping where I'm sleeping on a

one inch, hard [inaudible 00:28:29] mattress, otherwise I'm on a really nice bed. But if we're sharing the bed and we don't have separate blankets, she'll wake me up every single night. And then you look at this, you're married for a long time, decades and decades, and you just get 10% less quality of sleep for decades. You know, you might get Alzheimer's from that. That seems kind of crappy because it's not that expensive to buy two blankets.

[Dan:](#) Exactly. And you know, this is actually kind of an American thing almost, to have one blanket. If you go to other cultures, I think in Netherlands, for example, it's much more socially acceptable to not only have separate blankets, but sometimes even separate beds.

[Dave:](#) Something like 43% of Americans in a recent big survey said that they would love to sleep separately, but they kind of feel guilty about it, and the state that wanted that the most was Texas. I don't know why, but that was a cool fact of the day like 200 episodes ago.

[Dan:](#) Yeah. I mean, the state-wide statistics on sleep are kind of interesting. For example, Colorado I think is the state that sleeps the best.

[Dave:](#) It's all the guns?

[Dan:](#) You can imagine why that might be.

[Dave:](#) It's all the guns.

[Dan:](#) It's half-

[Dave:](#) I have no idea why, I just ... I grew up in New Mexico, we're like right south from there, so ...

[Dan:](#) Uh huh. Well, I think the guns might not help with the fight or flight response.

[Dave:](#) Well, that was my joke, is you could go either way in that argument, so ...

[Dan:](#) So, we kind of diverted again. But with the sounds, this is the really kind of sexy thing in the literature that brought me back to this topic. So, I was actually making sleep algorithms for your iPhone back in 2010. You know, the standard sleep with the phone in bed with you kind of thing to measure your sleep.

[Dave:](#) Oh yeah, I had your app back in 2010.

[Dan:](#) It was called ... no way. Really?

[Dave:](#) Sleep to Peak, right?

[Dan:](#) Oh, there was Sleep to Peak, and then there was also one called Proactive Sleep.

[Dave:](#) Okay.

[Dan:](#) Sleep to Peak is still out. The reaction time aspect of Sleep to Peak is really cool for measuring your circadian rhythms. I think you were interested in that.

[Dave:](#) Yeah, that was how we first met.

[Dan:](#) Yeah.

[Dave:](#) I was like, "Oh, this is a cool app. No one's ever heard of this guy, I got to meet him." But that goes back like seven, eight years. I don't know how long I've known you, but ...

[Dan:](#) I made that with a neuroscientist from Canada, Mark [Therean 00:30:48]. And we've actually validated that that task is just as sensitive to circadian rhythms and your sleep need than something called the psychomotor vigilance task.

[Dave:](#) That was your PhD thesis, right?

[Dan:](#) Yeah, that's what I focused on for my PhD, and we actually made artificial intelligence models that simulated performance on those tasks with stuff with micro lapses in the basal ganglia and stuff like this.

[Dave:](#) So, basically, if you don't get enough sleep you are not good at paying attention, noticing stuff.

[Dan:](#) Yeah.

[Dave:](#) And you proved it beyond belief. But you also, because we talked a lot about your acoustic cushion stuff. But you got almost \$1 million from the National Institutes of Health a couple years ago, and from the NSF, to improve sleep detection and increase deep sleep. And I want to know, given that we talked about sound, light, and temperature variables, and these are big things from *Headstrong*, my book, but these are what control your mitochondria as well. But was that part of that grant? Did you spend that \$1 million figuring out what light, sound, and temp do? Or was that other stuff?

[Dan:](#) Yeah. So, basically what happened was at a certain point with the sleep detection, I realized that you couldn't accurately detect sleep with just motion alone. And I actually gave up on trying to do this for like two years, and then when the Apple Watch came out, I knew that that was the time. And so that's when we applied for all these grants, and it was based also on this really sort of sexy finding in the literature that you can actually prime different brain states with sound. So, first and foremost what our lab is focused on is how to use sound to prime deep sleep. So, also when I was in grad school, this kind of famous professor with 30,000 citations to his work was one of my grad advisors. His name is Roger [Paraserman 00:32:43], and he was a pioneer in something I think you're very interested in, Dave, which is transcranial direct current stimulation.

[Dave:](#) Oh yeah.

[Dan:](#) Basically, there's things like headsets that you can wear, like Halo neuroscience, that does some of these things.

[Dave:](#) Do you mean like this headset?

[Dan:](#) Oh, there you go. Yeah, so we were actually zapping people's brains with low levels of electricity in grad school, and they would let us do it to undergrads because it really doesn't have a high ... it sounds a little sci-fi and out there, but basically the air force is really interested in some of this research to try to make super soldiers. I think that's where a lot of the grant funding came from, and there was a lot of evidence to show that you can improve mental performance with this. At the end of the day, the brain's connections are just a set of electrical circuits, right?

[Dave:](#) Yep.

[Dan:](#) And what they found is that they could get this similar effect with not just electricity, but also through acoustic stimulation because the auditory cortex basically processes that information, converts it into electricity, and you can actually prime these brain states without zapping people, but actually with sound. And so that's the main purpose of our NIH grants, is if people get less deep sleep, can we actually use sound played at just the right time, and this is the hard part, the right volume, in order to get the brain to entrain to it without pushing the person to an arousal? And so we understand the science behind that basically better than everyone else, I think, and we're the first lab to show that we can actually get this deep sleep stimulation effect on something as easy to wear as an Apple Watch or an Oura Ring.

[Dan:](#) So, there's other devices out there that already do this on a headset form factor, like you mentioned the Philips, and there's another one, Dream. But we're the first ones to show that we can do it with just measuring heart rate and motion on Fitbit or Apple Watch, Oura. Which we think is pretty innovative, and we show we can increase slow wave sleep and also next day cognitive performance in a paper that we just submitted to The Journal of Sleep.

[Dave:](#) Okay, this is groundbreaking stuff, okay? Going back 10 years, I'm sleeping with this incredibly sexy headset on, and now you're basically saying with the microphone on a common phone, you can get this.

[Dan:](#) So, there's a microphone that gets it to some degree, and then if you have an Apple Watch, Oura Ring, Fitbit-

[Dave:](#) Oh, you can have the heart rate from the ring.

[Dan:](#) You really need the heart rate to nail the effect. There's some benefits still with just the phone by your bedside. And this whole sleep with your phone thing is something I left way in the past, I am not a proponent of that at all.

[Dave:](#) Of sleeping with it?

[Dan:](#) A lot of people sleep with their phone in bed with them. To some-

[Dave:](#) But if it's on airplane mode and it's near your bed to collect sound, that seems okay, or no?

[Dan:](#) No, yeah, that's fine.

[Dave:](#) Okay, that's what I do.

[Dan:](#) I think that this, and this is something that I've personally comes to terms with recently, is my phone addiction. And I think that this is one of the main reasons why our generation is having some sleep issues, especially with sleep quality.

[Dave:](#) It's a major thing. Ariana Huffington, she is all about leave it outside your room or you'll die, and is a very big sleep proponent, and I'm always torn. The data for me, it says, "You did a good job," but my phone is exceptionally dim. I have a color filter turned on, and I don't look at the phone. So, for me it's working, and then I get progressive wake up alarms, which are also really nice, where it wakes you up slowly at the top of a sleep cycle. That seems pretty worth it, but you're right. If you're addicted to your phone, get the addictive stuff away.

[Dan:](#) So, this is why it's so interesting to me, is it's very ... I don't like giving generic feedback sometimes because I think it's very individualistic. Frankly, most people sleep with their phone by their bedside, so first and foremost, we try to measure your sleep using that phone by bedside form factor and give you meaningful feedback. And also, this is a big thing that I think almost always helps people. Wake up very gradually. That's the right way to wake up.

[Dave:](#) That saved my life. It changed everything, yes.

[Dan:](#) And so we try to do that, because since we understand how sound impacts your arousability, and there's also sleep spindles, and there's some cool science on a lot of this stuff. If you want to get deep into some of that, I'd be happy to do so. But so we actually start a sound to wake you up gradually. It's almost imperceptible, and then it ramps up over a 10 minute period in Sonic.

[Dave:](#) Yeah, I use it. I feel so much better all day.

[Dan:](#) Oh, you do.

[Dave:](#) Yeah.

[Dan:](#) Okay, cool.

[Dave:](#) And the difference ... try having a four-year-old run in screaming, and your whole day is wrecked. I mean, seriously, that's a big thing for how I perform the way I do, is how I wake up. So, yeah, that's beautiful and I love that it's built in.

[Dan:](#) And part of this also is to ... there's a thing in sleep science called the cortisol awakening response. Are you familiar with this?

[Dave:](#) Explain it for listeners. I am, yeah.

[Dan:](#) So, basically you actually want a spike in cortisol when you wake up in the morning. It's healthy.

[Dave:](#) Yeah, it's important.

[Dan:](#) It's very healthy, and I think one of the reasons why older people often sleep work is their circadian rhythm kind of flattens out. And also, if you have stress throughout the day, like chronic stress, you actually respond by this cortisol awakening response decreasing.

[Dave:](#) By the way, if I'm jet lagged, I'll take five milligrams of bioidentical cortisol the second I wake up to induce that response.

[Dan:](#) Oh, interesting.

[Dave:](#) When I need it. And I'm telling you, if you don't want to get sick when you travel, here I am with a super scratchy voice because I just had a lot of dry air. But it's completely changed things. It's an old school 1950s hack for jet lag. But you need that, and you also need an acid spike in the morning. So, this wake up and drink some sort of alkaline water, it's BS, but lemon juice or lime juice is great because it actually provides acid. And eventually, it's metabolized to be alkaline later in the day, but you do get the acid spike in the morning.

[Dave:](#) So, get some cortisol, get some acid, the things that are supposed to be bad, not when you wake up, but you don't want to slam it on, which is what happens when the two—year-old or the fire engine honking or something wakes you up. A startle thing is you dump all the cortisol, and if you get a normal cortisol ramp that starts right before you wake up, and I think with your app, that 10 minute slow wake up allows cortisol to come on slowly. Is that accurate? Is that happening?

[Dan:](#) I mean, I haven't run that study yet to unequivocally say that.

[Dave:](#) Oh, come on, man. Do it.

[Dan:](#) But I mean, it's just definitely better. Part of the other reason why I'm 100% sure that the gradual wake up is the right move also, is that when you did have poor sleep quality, which can happen sometimes, you'll get that extra couple minutes of sleep, which I know is going to be, is regenerative.

[Dave:](#) My buddy, Maneesh Sethi, started Pavlok, which is ... and I made a very tiny investment in Pavlok, because I couldn't not do it because it was funny. But he has this wristband that works really well for breaking or forming new habits, especially stopping smoking. And it runs a little electric current that shocks you, so our bodies are so averse to negative stimulus. Then, he was like, "Well, let's use that. Every time you smoke, you actually push a button and it shocks you and your body is just like, I just don't want cigarettes anymore. I don't know why." But he yells this thing about, "Get out of bed right away. Jump out of bed in the morning." And so you can set it up to shock you out of bed and train yourself to get that really basically sharp cortisol spike. I'm assuming that's what it does, but I don't know that I would want that.

[Dave:](#) I really value that 10-minute slow wake up where you can finish your dream and remember it and all that. Any thoughts on pros or cons versus just natural, or training yourself to hop out of bed?

[Dan:](#) Yeah. I mean, so there's healthy stress and there's unhealthy stress, right? I don't think you necessarily want to stress the body in a way that's causing you a lot of discomfort per se.

[Dave:](#) It's only a little. It's not like you're twitching for hours, it's like a little rubber band snapping your wrist.

[Dan:](#) No, I'm fascinated. But I mean, as a biohacker, I've definitely looked into the Pavlok. I was actually looking at their patent the other day for some reason. It is an interesting thing, and this also sort of brings me into a topic that is a little early, but I can talk about it a little bit. Is this finding in the sleep literature that through a similar kind of associative process, you could potentially prime your subconscious mind to basically have memories for targeted things that you want to control through the process of sleep. And this new research called target memory reactivation, have you looked into this at all?

[Dave:](#) No.

[Dan:](#) So, there's these cool studies. It's still a little early and it's not 100% sure that it's ... you know, there's some evidence for this. I'm not going to say that it's 100% yet, and we're trying to explore it. But if you do a task during the day such as trying to remember all 50 states or any kind of memory task, while you're smelling something, for example, and then you replay that smell while someone is in REM sleep, it's a similar kind of thing to what the Pavlok is trying to do a little bit, with the Pavlovian response. Basically, the smell primes when you got the right answers for the task, for example, and you re-encode that information more so, and then you do better in the task the next day with the cue.

[Dave:](#) That is super cool. So, we need a little smell generator in our bedrooms.

[Dan:](#) But you can also do it with sound, so that's something that we don't have yet, but we're exploring.

[Dave:](#) Now, I'm really interested in that, so maybe you play that sound when you're doing homework or learning a language. There's probably all kinds of cool stuff. One of the techniques that I've used, when I do certain types of neurofeedback where you're getting yourself into these very advanced meditative states, like the 40 Years of Zen style stuff, recording the sound of the neurofeedback session, and then playing that back before bed to cue those same mental states, especially when I'm doing very deep states work. I can't say that I have data that it works, but it feels good. Maybe that's part of the same thing.

[Dan:](#) No, and I mean, the stuff with alpha and really understanding alpha is something that is very fascinating. I think that's the brain state that you're looking at when you're doing this.

[Dave:](#) Oh, no, at 40 Years of Zen, we are looking at the new research on Zen meditation, is all about gamma.

[Dan:](#) Oh, okay.

[Dave:](#) How it mixes with alpha, and there's even some delta and some theta depending on what areas of the brain. So, but alpha, for the reset process we do there is important, but it goes deeper than alpha.

[Dan:](#) Okay, interesting.

[Dave:](#) I don't want to go that deep on that stuff now, because it's less sleep based. You've got sound I think pretty much nailed into this heart rate stuff, but the work you're doing also has light and temperature. Let's talk about your recommendations around light for improving sleep, because that's a big part of *Headstrong* and a big part of what I do.

[Dan:](#) Yeah. I mean, so I think you nailed it with the red light at night. You know, it just makes sense.

[Dave:](#) I have one of my portfolio companies that I started, the True Dark company with the glasses, yeah. We're into that.

[Dan:](#) Yeah, I mean, it just makes sense and there's recent research that there's actually these basal ganglia cells in your eyes that are particularly sensitive to red light.

[Dave:](#) Yep.

[Dan:](#) And it actually, they used to think that the red light makes it so light doesn't activate the melatonin.

[Dave:](#) Yep.

[Dan:](#) But they're actually showing that the red light actually has a ... it actually makes you tired. And they think that that has to do with ... the explanation from a theoretical

perspective, which is usually how I try to understand things, is that when you ... a sunset that we were exposed to for thousands and, you know, tens of thousands of years, actually primes this response in us to fall asleep, and it just so happens that sunset is red.

[Dave:](#) All right.

[Dan:](#) So, it kind of makes sense. And they've done these studies in mice and stuff, you have to dissect the eyes and whatnot.

[Dave:](#) It doesn't just make sense. I'm laughing that you said that because there's a patent for True Dark, and my name is on it, which is why I really dug into this stuff. It turns out that the angle of the light and the color coming into the eye matters, so we just launched last week something called the True Dark Sunsets. And what we did is, we used the layer of filters which blocks all of the colors that are bad at the top of your vision where the light comes in in the middle of the day. But we have less of that filtering at the bottom of it so you can still look down and see what's going around. So, it's literally like a sunset.

[Dan:](#) Awesome.

[Dave:](#) It's dark, at least your brain thinks it's dark up, and lighter at the bottom so you can still get stuff done, and they still block all the melatonin and all. But the idea is you can see a little bit better and people can still see your eyes, and those definitely-

[Dan:](#) Huh, oh that's fascinating.

[Dave:](#) Plus, they look a little bit less like someone from X-Men. You know, they're aviator style. But it's-

[Dan:](#) I want the Cyclopes [crosstalk 00:46:56].

[Dave:](#) I know, I kind of like that, too. But it's funny, you said sunset, I'm like, "Yes, exactly right." Because it sends a signal to the basal ganglia, and I find that to be fascinating that it may not be just the color of the light, but the angle that the light comes into the eye as an important variable.

[Dan:](#) Hm, I didn't know that intricacy of it. Interesting. I think there is a lot to be said for light, and one of my ambitions here is to try to create these, we call them my sleep habitats, but theoretically, you have an ideal light exposure that entrenches your circadian rhythm. And we're actually trying to work with cognitive behavioral therapists to make a software to try to add some of these light interventions to improve something. I'm not a medical doctor and this is still far out, but theoretically you can improve therapy with some of these light exposure and deep sleep stimulation interventions.

[Dan:](#) So, light kind of seems simple. You know, you want red light at night and you want blue light in the morning, basically, and you want to get at least 30 minutes of sunlight before 12:00 noon. But there's nuances in this, and I didn't even know about the angle thing,

but I know a lot about the color spectrum. And so theoretically, based on your unique circadian rhythm, there's an optimum color in your environment, and we're trying to integrate with various devices like LifeX Bulbs and Philips Hue to try to make this aspect of the technology.

[Dave:](#) Okay, that's super cool. But basically, red light is a big thing, avoiding blue light. Okay. One of the things that I think is fascinating is you didn't just study psychology and cognitive side of things, but you also looked at A.I. as part of your research, and you talk about Sonic Sleep A.I. and what is the role of artificial intelligence in making sleep more regenerative in the way you're looking at it?

[Dan:](#) Yeah, so I mean this is what gets into all the personalized feedback that we're providing. So, when we know people's sleep quality and when they went to bed and when they woke up, we can start giving people personalized suggestions. And the way that I like to look at it is there is always one thing that anyone can do that's maybe a relatively easy thing that they can do to improve their sleep quality. And that's different for different people. If you want to optimize, maybe it's having a more strict bedtime or maybe taking a power nap. If you have insomnia, it could be the cognitive behavioral therapy things. And so what we're trying to do is detect uniquely what's going on with the person with these wearables, and then create this sort of A.I. assistant on top that gives you that relevant feedback, so when you wake up in the morning you don't say, "Oh, my device said I got X amount of sleep." You get that, which is definitely useful, but it also says, "Look, here's what you can do tonight to improve your sleep quality the next day."

[Dave:](#) That's cool. And I've got one more question for you, Dan. I used to ask people the question, I know you listen to the show, the question that formed the basis of *Game Changers*. And I feel like with a sample size of almost 600 people now, we understand the smarter, faster, happier thing. And for people listening, if you haven't read *Game Changers*, seriously it's 500 hours of podcast boiled down to the most important stuff. Read it. So, I'm not asking that question anymore. The new question is more of an anti-aging question and it comes down to, how long do you want to live?

[Dan:](#) I mean, so my thing is, I don't want to live in an encumbered state.

[Dave:](#) Nobody does except if you ask people who are in encumbered states if they want to die, the vast majority of them say, "Not yet." So ...

[Dan:](#) That is true. There's very interesting research on quadriplegic people related to that very question. I mean, I'm happy with 120. My grandpa lived to 102, and he's distilled some of the secrets to longevity to me, which believe it or not was eat cheese, chocolate, and wine. Which is kind of a little anecdote, but if I had my wits about me, and towards the end of his life he suffered from dementia, and that's probably what inspired me in this space. You know, I wouldn't want to be in that situation. But if I could be 120 and still have my wits about me, I would be more than happy.

[Dave:](#) All right, I love it. 120. What if you had your wits about you entirely? Not 121?

[Dan:](#) I guess the more the better, I don't know. I'm a little bit ... I guess there's a darker side to me that's like, I think after a while I might just be done with all of this.

[Dave:](#) I say my number is at least 180. The real answer is, I would like to die at a time and by a method of my choosing.

[Dan:](#) Interesting.

[Dave:](#) If I'm done, I'm done. No problem. No harm, no foul. But until then, I'd like to feel really good and do a lot of good work and give back, and you know, discover things.

[Dan:](#) I mean, that's the thing. To die in a prolonged state and having that burden on your family, my-

[Dave:](#) No, once you're born, you're dying in a prolonged state. That is the human condition right now, until we-

[Dan:](#) Well, I guess we're always dying.

[Dave:](#) Until we fix it, that's the human condition.

[Dan:](#) Good point. But to be able to do it without putting a large burden on your family, similar to what you're saying.

[Dave:](#) Yeah. Or society, right?

[Dan:](#) Or society.

[Dave:](#) But let's just assume that that picture of being old, I know people who are in their 90s who are dating people decades younger than them who are moving around and functional. Eric Kandel, who's been on the show, Nobel Prize winner, he's 94, and he has a lab in New York City looking at neuroplasticity, and he's still working and loves his life. I'm like okay, if that's what it's like, does your math change?

[Dan:](#) I guess I could go 150.

[Dave:](#) Ah, there we go. All right, we got you up, all right. Now you're at least in the minor leagues. I'm just kidding. But it's interesting because all of us have this preconceived notion that being old means being a burden, and in my experience, I have several friends 70s, 80s, 90s, and those are some of my most valued friendships. Talk about wisdom, right? So, if when you're older you have wisdom and all the experience and knowledge, and you've seen things that younger people haven't seen, and you're comfortable and you're happy and you're giving back, and you're not a burden, you're actually the village elder. We need more of that, we need a lot more of that.

[Dan:](#) That is interesting. With your whole live to 180 thing, if you're creating this society of wisdom, you could see that would have a huge positive effect.

Dave: It is exceptionally difficult to be an asshole for 180 years. You have to evolve, and I know, because I used to be a really big jerk when I was younger. I didn't even know what I was doing. I mean, I had brain inflammation. I was a total jerk, and I like to think I mellowed that out a little bit. And I know by the time I'm older than this, I'll probably have done some more pattern recognition on myself and on the world, and it'll just make me better at improving myself and better at helping the people who want my help, and great. So, I want the world to start thinking of, wow, you're 90, not you're helpless, but tell me what it was like. I asked my grandmother this, "Tell me what it was like when you were measuring neutrinos from the first reactor ever," because she was a nuclear engineer. And she said, "Yeah, I remember that." And you're like, "This is amazing." And so I want more of that.

Dave: And plus, Dan, if we're going to live that long, you're probably not going to be putting micro plastic in the ocean. We're going to solve those problems, because I can't mess up the sand box because I'm going to be here for a long time. So, we have to be better stewards of the world.

Dan: Yeah. Actually, I never thought about the ... when you say you're going to live to 180 years old, it actually makes you think more long-term and make probably better decisions in the shorter term, too. Even if it's not actually something that you're actually going to maybe do, and I would love to see you do it-

Dave: Well, that means you have to do it, too, if you want to see it. See, that's the hook.

Dan: All right, 180, that's it.

Dave: All right, man. It's a bet. We'll race.

Dan: Okay.

Dave: Cool.

Dan: I got some time on you, so ...

Dave: Beautiful. That means that's a big advantage, because it's getting better every year in terms of what we can do about it. All right, if you guys liked today's episode including that dark ending about death, well, check out SonicSleepCoach.com, which is Dan's website. It's an app that I do use and an app that I appreciate, and I'm really looking forward to hearing what you guys think if you decide to check it out.

Dave: Because adding that acoustic cushion is one of the things, when I slept that three and a half hours, I guarantee you there's Sonic Sleep going on because otherwise in a hotel room with all the other garbage going on that same day, I don't know how I would've slept as well as I did without doing everything in my power to sleep well. And I took Bulletproof Sleep Mode, I wore the new Sunset glasses from True Dark, and man, I mean, I did breathing exercises. I did everything I could think of. But certainly, Sonic

Sleep is a part of what allowed me to achieve that, which is frankly an unusual result even for me, but I was pretty stoked on it. Have a wonderful day.