

How Measuring Brain Function Leads to Performance Upgrades – David Oakley, Ph.D., with Dave Asprey – #867

Announcer:

Bulletproof Radio, a state of high performance.

Dave Asprey:

You're listening to Bulletproof Radio with Dave Asprey. Today, is an in-person interview. Hooray. It's almost like doing things the way it's supposed to be because we are at the 7th Annual Biohacking Conference. And at the very beginning of the biohacking movement, I started a conference with 100 people to say, let's get together and play with the technology. And now, we have more than 100 vendors, 150,000 square feet and thousands of attendees. And that makes it a really successful fun conference. I'm here in Orlando doing interviews for the show before the conference starts.

Dave:

And today's interview is with David Oakley. David is a physicist, who has created a technology that you've heard of if you're a longtime listener of the show, called WAVi. And the idea is how do we get a 360-degree view of how our brain is performing and we need to do it in a small amount of time. And it's a luxury to go say, "I'm going to spend a day with injecting radioactive dye and looking at my brain performance." By the way, I've done that a couple times and it was profoundly transformative, so that's worth doing, too. But if you wanted to do this once a week, or once a month or twice a year, it would be kind of crazy. So, WAVi fills that ability.

Dave:

And we're going to go deep, because I've got a super smart physicist who comes from a family of inventors. And we're going to learn about things that you might not know about whether your brain is causing something or something is causing your brain. David, welcome to the Biohacking Conference. Welcome to Bulletproof Radio.

David Oakley, Ph.D.:

Thanks for having me.

Dave:

All right, let's talk about why you would get a PhD in Physics. What's wrong with you?

David:

That's a good question. You want the real answer as your answer?

Dave:

Absolutely. PhD in Physics, by the way, are some of my most favorite people, because your brains are always just weird. PhD philosophers and physicists have 90% Venn diagram overlap. But what made you go into this if you could have gone into any field at all?

David:

When I graduated from undergrad, I had choices of law school versus physics school. And I took the physics tests, which I found out later, a lot of grad students took it as well. And so, I was just average, so I thought I didn't have a chance of getting into physics, so I did my law school backup. And I was in the top one percentile on my LSAT or something. So I thought, I'd get in all the law schools, I didn't get into any law schools. Got into every physics school, so here I am.

Dave:

That's because you're the only person applying. You realize that, right?

David:

Yeah. Probably. I finally called one of the law schools and asked them why, one that I should have absolutely gotten into. And they said, "Well, sir, your application was three months late, so you would not make a good lawyer." And-

Dave:

Also that you'd make a good physicist, the absent-minded associate. So, I'm totally stereotyping. And there's a lot of physicists who listen to the show, I'm sure, who are going, "Dave, are you insulting me or complimenting me?" And the answer is both.

David:

The physics is beautiful. It's like art.

Dave:

It is. Yeah. Okay. So, you were attracted to it and the universe pushed you in that direction, we'll just say.

David:

It did.

Dave:

And look, your grandfather invented the coiled heating element, by the way, if you guys think about this. How many cups of coffee have been heated with water that this was what your grandfather invented?

David:

Yeah, he did actually.

Dave:

Okay, that's kind of cool. And then your dad was a disposable hypodermic, so, "I'll just invent that."

David:

Yeah, they're both crazy. It is. My grand, it was during the depression, he needed a job, so he invented the coil heating element and they gave him I think a check for five bucks for the patent and he still have it framed.

Dave:

That's so cool.

David:

He refused to cash the check. Yeah, it was so insulting.

Dave:

He didn't cash the check. That's even better.

David:

Yeah. And my dad was working with people at Addex, doing rehab. And in Colorado, for some reason, it was hard to sterilize them. It's the needles, so he said, "Well, what if I can invent it, so we can throw them away?" And so, he messed around with all these different alloys. He would get a good alloy that would stretch and the disposable needle was born.

Dave:

That is incredible, so-

David:

And hired all of his Addex for it to work, help build the needles later.

Dave:

Oh, man. All sorts of jokes you can make about that. I guess, as long as they're over their addiction that would be totally fine.

David:

Well, I don't know.

Dave:

It was [crosstalk 00:04:25].

David:

I'm not sure they were over there.

Dave:

It was the '60s. What the heck?

David:

Yeah, yeah.

Dave:

I mean, things were a little bit different back then. All right. So, you come from a line of people who invented stuff, that actually is billions and billions of people have used those things. And then you went

to work for Los Alamos National Labs, which a lot of people haven't heard of. And in the US, there's five major research laboratories that are working on some top secret stuff. My father, my mother, and my grandparents, all come from National Lab background, so I know about all this stuff. And this is where you know combustion research, core science, anything with high-energy lasers, and gravity and all sorts of cool stuff happens.

Dave:

So, you ended up going to Los Alamos National Labs. And then all of a sudden you got into brains. Where's the transition to looking at the signal coming off a brain versus what physicists normally do?

David:

Yeah, yeah, that's a good question. I guess, I can call it a midlife crisis. I was happily doing Neutrino Astrophysics, analyzing the data. Then, I met David Jaffe, who co invented the first pulse oximeter. He lived in Boulder and he was, just introduced me to the brain data. And he invented, he had a company that NEBA Health is what they are now and they had the first ADHD marker that were approved by the FDA. But, and he just got me intrigued by the data. He started showing all the patterns. And I thought, "This is beautiful." It's beautiful waves. You can do a lot with it. You can help people, which is novel because I was Neutrino Physics, I'm not sure how that could ever help people, but it was beautiful, and just decided to make the jump. It's about the same as physics, though. It's the same, just voltage versus time series data.

Dave:

So, you realize when most people have a midlife crisis, they buy a sports car. And as a physicist, you said, "Oh, I think I'll go into brains." But it's kind of the same thing, but just from the way you see the world, right?

David:

It was going to make me live longer, so I haven't hit my midlife yet.

Dave:

There you go, I love that.

David:

So, I'll buy my Ferrari when you can optimize me.

Dave:

You're probably the first person I know of to say, "I was in a kind of midlife crisis, so I decided to study brain science." But I can respect that greatly because that's something I would do as well.

Dave:

You started looking at the data, and you said, "Wait, there's as much data here as we have when we're looking at Neutrinos or Quarks or Beauties, or any of the other advanced physics stuff that is interesting. And tell me about the first time you saw brain data. What went through your physicist's mind when you were sort of making that transition to it?"

David:

What amazed me. It still amazes me every time. We have thousands of, I've gone through thousands of data sets, personally. And what amazes me every time is it's a beautiful pattern, so somehow all the neurons, there's a lot of neurons, somehow they form this pattern, these alpha waves. You've seen them, beautiful waves. How's it really happened? What does it mean? We don't really know, right? I just, people think they know, but you can read our articles on alpha, and you'll see 1,000 different opinions on 1,000 different articles. And it's just beautiful, it's intriguing. It's artistic.

Dave:

It is quite beautiful. And with WAVi, the company where you've created the technology, you have this really cool and probably the most TRON looking thing I've seen. Headsets made from some kind of foam like the same stuff as Crocs, right? And you put it on and then you can get a signal very quickly that say, "How's my brain doing right now?" And you guys did an assessment a while ago for me, probably a couple of years ago when you were first on the show, at least when WAVi was first on the show. This is your first time on and-

David:

We did. And you need to do another one by the way down at the conference.

Dave:

I do. Okay, if I can do it without getting-

David:

To make sure your brain is still firing on all cylinders.

Dave:

Yeah. As long as I'm not getting gunk in my hair that's going to screw me up because I'm emceeding the conference, so I am on 12 hours a day, so you can't make me look like-

David:

Oh, no.

Dave:

Because there is a little bit of gel with this thing, but it's not much.

David:

No, no. No gel.

Dave:

You got rid of all the gel?

David:

Yeah, basically just some saline.

Dave:

I thought we had to do some squirty gel. Just saline? All right, we can do it. All right.

David:

Yeah. yeah. We don't like gel.

Dave:

I don't like gel either, but I swear to God. Maybe, my hair was just wet at that time.

David:

So, I don't know who did. Hey, [inaudible 00:08:41] did you do that to him?

Dave:

Did we get a little gel into them?

Speaker 4:

I had to use a little [inaudible 00:08:45].

Dave:

There we go, so not too bad.

Speaker 4:

We just rolled out the [inaudible 00:08:50].

Dave:

So, guys, before the gel, what the heck were you talking about?

Dave:

In order to get a good signal from the brain, you need to make good contact with the skin. And in order to do that quite often, there's gel or paste and it can be really, really, like screws up your hair. So, what's cool about the WAVi system is that there are some little saline things that you kind of get them wet, right? So, it's just water in your hair, except in my case, because we were doing something advanced, they put one spot of gel on my forehead, which is what I'm remembering.

Dave:

But the cool results I found are and I remember, in fact, I've shown the graph to a few friends. There's a signal like how fast your brain responds, it gets slower as you age. And my brain response time was the same average as a 20-year-old. Like, I think...

David:

Yes, it was.

Dave:

... something I'm doing works. But this leads to the question. Correlation versus causation, how do we know what I'm doing is making that work?

David:

That is good question because a lot of these things were measuring, some of them are your state. They're hereditary and then some things are your... sorry, they're your trait. They're hereditary. Some with similar states. And so, the real goal is to find out who you are and keep you there. So, if it can measure you at 20, keep you at 20, that's ideal world. Now, you do so many, so much stuff. We need to work with you more and find out what are you doing because we don't know. But whatever it is, it's working. And we see a lot of people. Sometimes, it's as simple as just heart health. It makes a huge difference, which.

Dave:

I mean, it's hard to prove this, although I would argue there's enough papers out there that you probably could prove it, at least make it most likely. Increasing heart health, where do we have the most mitochondria? It's in the heart and in the neurons, unless you're a woman, in which case it's in a few cells in your ovaries. And so, if you're going to do something that makes your heart work better, you can make more electricity in the heart, you're likely to also be making the mitochondria in the brain work better. And that was the whole synopsis behind my book, *Headstrong*, so we can do this.

Dave:

But then how do we know that it's working? Because there is no great measure of mitochondrial performance that's out there without taking like a punch biopsy of your quadriceps or something. And even then, your brain and your quads might be different. So, your approach is, "All right, let's look at how fast the system responds." Explain what WAVi is looking at for this performance measurement?

David:

Yeah, one of our philosophies is keep it simple. There's a lot to that. One of my mentors in grad school was best friends with Einstein, and they hang out in Princeton.

Dave:

Wow.

David:

And if they had an idea, they grabbed some random person. They really did this, by the way, grabbed some random person on the street and say, "Hey," and tried to explain their theory to them. If that random person didn't understand, then they'd say, "Einstein, you don't understand it yourself. Go back work and your theory." So the idea is if you simplify, location is kind of built into me, how to make things simple. So, our test is real simple, we just give you a task, a subconscious task, and then see how long it takes the brain to do the calculation.

David:

All right, it's just the Oddball P300. It's been around a long time. It's easy to standardize and so, we've picked that one up. So, that's how our brains work. If I give you with my right hand, I'm clicking with my

left hand, I'm clicking, your brain it takes about 300 milliseconds to say, "Wait, that was different. We got to do something." And so, it's just that simple calculation that we track over time.

Dave:

So, you're tracking that 300 milliseconds. And if you're looking at a Formula 1 driver or a video game or something like that, their response time is likely to be lower, right?

David:

Could be. We haven't done that study, so I don't know. But I do know that people who talk fast, like me, I like to speak before I think. That's why podcasts are problem for me. But people who talk fast typically have a really fast P300.

Dave:

Interesting. So, that's a signal of it. And what about things like a mental illness, Alzheimer's, cognitive dementia? What happens with this simple performance indicator for the brain, the P300?

David:

You see, so as you age this performance drops, the speed drops.

Dave:

Well, it's supposed to drop in the average person.

David:

It's supposed to, yes. Again, you got to keep me young, so I can buy my Ferrari in my midlife.

Dave:

You got it.

David:

You have the hard job. I just have to measure this. But yeah, it dementia, it really drops it. Alzheimer's drops from 300 to around 400.

Dave:

Wow.

David:

Oddly enough, concussion doesn't change the speed. It changes the voltage. There's a response, your brain has a response voltage to that signal a lot, that factor of two. But it doesn't change the speed, oddly enough.

Dave:

So, this is a really big thing. And I want you guys to think about this. You're saying like, "I'm not a brain scientist, I'm just listening to this." But there's, how fast does the brain respond? And how strongly does the brain respond? Because those are different things. And the reason my brain does what it does, I

would say is clearly nutrition and mitochondrial enhancement and supplements and all that kind of stuff. But I've done a lot of training of both organizing networks in my brain, but also specifically of training voltage in the brain, which you can train to go up. So, that's part of the 40 years of Zen experience is some voltage training where you can actually train the nerves. "Oh, you're supposed to make more electricity."

Dave:

And I've had a couple serious concussions even after starting Bulletproof. I remember once I sent a super angry email to Tim Ferriss for nothing he did because when you have a concussion, you're just an angry jerk. And I apologized to him when I figured out that was going on. I was like, "Sorry, Tim. I didn't mean to be a dick." But that sort of thing really does happen and I did not measure my voltage at that time. But I do have pre- and post-imaging of all this stuff and my brain was spaghetti. The networks worked right and I swore all the time and it was not a pleasant thing. So, you would have been able to if I mean, if you know yourself was out when that happened. But you would have been able to look at this and go, "Oh, look, your voltage is way lower than it should be."

David:

Yeah, and it's simple. It's just simple.

Dave:

And your vision is to have WAVi in the doctor's office like a blood pressure cuff to say, "Hey, how's your brain doing today?"

David:

Right. Yeah. Everybody should track their brain. It's a no brainer. It's easy to do. [crosstalk 00:15:22] fine.

Dave:

I see what you did there.

David:

It's a no brainer. It's just [inaudible 00:15:25].

Dave:

Was that on purpose?

David:

Yes, that's all I can do here. Yeah, it's easy to do. Why not? People measure their weight every day, right? Step on the scale, "Where am I at today?" So, we should be measuring our brains regularly.

Dave:

Wow. I agree. I would love to be able to do that.

David:

It's easy. It's simple.

Dave:

I believe that what you've got with WAVi is probably the highest level whole systems health marker you could do. Because one view on reality is that the body exists to make the brain go and there's another marker that says the brain exists to make the body go, but I think it's the first way. And there's intriguing little studies out there, like the size of your butt muscles, not just your butt in general, is correlated with the number either of neurons or neuronal connections. So basically, stronger glutes and quads equals better brain performance.

David:

There's a study.

Dave:

Time to do squats.

David:

Yeah, we could do pre, post squats. So, it's really. That's interesting. I've not heard that one.

Dave:

Because so, that let's just say that there's clearly a correlation between what the brain does and what the body does. And there are some people listening who probably are fuzzy on their science around correlation versus causation and just to define terms for you. Causation means if you do A it always causes B. But a lot of the science including stuff you see from Big Pharma, a lot of this other stuff is saying, "Well, we don't really know that A causes B, we just know they happened together." And as a systems guy or a systems biologist or a network thinker, whatever you want to call it. Sometimes, it's like you could do A or B, right? And then the other one goes, so that they move together, but you can't say one causes the other.

Dave:

And I want to go deep with you because you're a physicist, because you guys have unusual brains. And you in particular, because you went from one field into another field, which means you don't think the way someone who went to grad school studying neuroscience would think. So, you're a disruptive thinker by definition because you had your midlife transition. So, talk to me about brains. How do we know what causes what in the brain?

David:

This is something I had to learn because in physics, we're trained to look at causation. That's what we do. And I've seen so much brain data and the brain is so complicated that at some point, it's easier just to give up on the causation and look at the correlation, make sure the correlations are decent. This voltage signal is so ideal for artificial intelligence to analyze it. But in that, you have to give up. You don't know what the artificial intelligence is seeing, but it can see patterns that we can't see.

Dave:

For sure.

David:

And so, if one does an MRI, so those are always causation based. Where's the blood going? But in our data, we've kind of given up on that in a way. I mean, it's still interesting to go backwards and see what you're seeing. But for example, we have a data set that NIH funded study to look at opioid rehabilitation and pain. And so, gave it to one of the students to analyze, and the student came up with an artificial intelligence program that could detect the difference 90% accurate, 95. So, with the four seconds of data, I think is what he used, something like that. He could detect people who were addicts versus people that weren't truly in pain.

Dave:

Wow.

David:

And control also, so a three-fold separation. We don't know what the artificial intelligence were looking at, but it found the pattern. So at some sense, the brain is so complicated, maybe this is going to be good enough right now. We can go back and do the studies, the MRI studies. They have done, one of our collaborators has done a lot of MRI studies on pain, so they can see different pain centers, in group settings. But on individuals, it's different animal. I can say, "This is your pain center." But it's not really your pain center. It's the group average pain center and so, you're going to be different.

Dave:

We have that problem in Neuroscience, where the QEEG, the Quantitative EEG and WAVi does not do a Q, because you don't need to for what you're doing, right? I mean, you would in research, but when you're at a doctor's office or a clinic assessing brain performance, you don't.

David:

No. We do have a couple Q parameters in there because doctors they like [crosstalk 00:19:50].

Dave:

[crosstalk 00:19:50] is a-

David:

No.

Dave:

No, it's not? Okay.

David:

It's about response, yeah. The Q would be like the theta-beta ratio, for example. Doctors like that one. But, and we do put a Q brain map in there for the people who want it.

Dave:

So, there's a full Q in there?

David:

Uh-huh (affirmative).

Dave:

I didn't realize that you were doing that.

David:

For those who want, yeah.

Dave:

If you want it, okay.

David:

Most of our docs don't want. They don't want just the simple because they're in a hurry.

Dave:

Those are it's important. Yeah.

David:

You have seven minutes with the patient, so it's got to be quick.

Dave:

So, what I prefer to do if someone's going to do a QEEG is you have to have a Neuroscience, not a doctor, because your MD won't know what to do. Look at it and go, "Hmm, here's what's going on." And it's a full-on exploration of the brain if you want to get into it. Otherwise, just getting it on paper doesn't matter, but the risk of a quantitative EEG and this is more for listeners. You obviously know that stuff. It's that if you take an average of 1000 or 10,000 brains, and you say, "Okay, this is the average." And you make that normal.

Dave:

Well, you could say that's it's great, so then now, let's do some brain training and let's train you to be normal. Except normal, another word for that is average, right? And if you're even 1% above average, you're abnormal. So, half the population is going to get made dumber by that kind of training and half is going to be made better. So, the A students become C students, the F students become C students, and that seems like a horrible world, right?

Dave:

So, Qs are useful, but on an individual basis like, "Do you want to look like everyone?" It's like that that song they made a while back, of like looking with the average of people like in music, and they made a song no one could listen to that should have been the most popular song ever. We don't want to do that in our brains, right? How do we avoid that?

David:

Right. There's a book, Everybody's Normal Till You Get to Know Them. I think we just have to be careful. We have to find out who you are and people have to learn to work with their own brains. Then we have

a situation in the company. We have this theta-beta anonymous, theta-betas. But it's not anonymous, because we know everybody's brains.

Dave:

So, what you're saying the people who work at the company is looking at each other's brain.

David:

Yeah, it's kind of a joke, yeah.

Dave:

Yeah, we want to do some of that. [inaudible 00:21:58] is into, which is a very different kind of company.

David:

Yeah, like, "Ooh, ooh, ooh, ooh."

Dave:

WAVi is an equipment manufacturer [crosstalk 00:22:04]. It's super clear, yeah.

David:

Yeah, yeah. So, theta-beta is the famous ADHD mark, but at some point, just people relate to that database marker and said, "Well, I identify as ADHD." But not as a disorder. They can use it to their strengths. So once they know who they are, so you could say, "Yeah, theta-beta should be in this range," but it would hurt some of the people that, for example, some of the quarterbacks. We've measured a lot of Hall of Fame quarterbacks. They have high theta-beta. They have to see everything at once. If they focus one direction, they get killed. However, we've also measured some Superbowl winning defensive backs, they have to focus. So, just different brain. Is that a disorder?

Dave:

Wow.

David:

If they all were normal, like you said, the quarterback would get killed.

Dave:

Interesting.

David:

Yeah, so-

Dave:

So, even different positions on the field have different brains. It makes so much sense, doesn't it?

David:

Right. Well, then we got to appreciate the differences. If it becomes a disorder, then yeah, do something about it. But the first step is to know thyself.

Dave:

I've had ADHD for my whole life, and probably don't have nearly as much of it now, just because you can tune the brain. But it is absolutely a superpower. It means you only pay attention to stuff you care about. And as a researcher, for instance, and there's no shortage of ADHD in Physics and Chemistry and hard sciences. Like it's abundantly common engineering.

Dave:

So, it's good because you just filter out all the stuff that's not the most interesting and it's bad, because you might have three interesting things and you bounce around. And so, but to say it's a disorder, a lot of that is because people are taught, "Well, you're not normal, therefore, you're bad," versus "You're not normal, therefore, you have a potential superpower if you amplify that. And that's a big part of my life's path has been figuring that out and then learning how to amplify my strengths and the weaknesses. Honestly, I can hire someone to do that or I can ask for help.

Dave:

You're going to have to pay people to do it because there's people who have their superpowers are my weaknesses. I'm like, "Can we be friends?" And then it works.

David:

Yeah. I mean, teams work well that way. Like somebody in this room who may or may not have high theta-beta create sales, but there's of low theta-beta people come around and say, "Okay, did you get the email out?" Which is perfect, perfect team. Let people be who they are.

Dave:

So, with the WAVi gear, do you see a future where, "Okay, put on the WAVi." Get a brain scan, a brain performance scan. and then get a map that says, "Here's who your friends should be. Here's where you suck. Here's where you're great.

David:

Yeah, you have to be careful with that, right? You could take the richness out of life.

Dave:

You can, right?

David:

But at least, you know thyself. We've seen, it's very interesting. Some people have said this has been great for marriage counseling.

Dave:

Oh, yeah.

David:

Because one, the husband in this case was really, had a slow P300, not abnormally slow, but slower, slower, right? He is a very slow, thoughtful person, with very deep voltage. The wife had a very fast P300, kind of like me, but not such a big voltage. And so she wanted quick responses, he wasn't giving it to her. So, once they saw each other's brains, they got it and their marriage has been so much better. It's a true story. Yeah, that's like-

Dave:

I totally believe it. I mean, I have the same setup at my house where I'm superfast. And sometimes, I'm like "Could you talk?" And then if you do cognitive enhancing things, like I remember when I first went on modafinil a long time ago, I was on this. And if you guys, if you're new to the show, modafinil is the limitless drug. A performance enhancing drug that works for ADHD and narcolepsy, but I took it every day for eight years. And that may be why my P300V is so fast because I just got used to running on modafinil. I don't use it now because I don't need to. When I eat all the right stuff and whatever I am so sharp.

Dave:

But... It's also the fact that I think I probably improved my P300V and there might even be studies on modafinil and all that. But whatever it was, it's like the universe has opened up, kind of in that movie, Limitless. You see Bradley Cooper there. And I know for a fact that whoever was doing the editing and the camera work in that movie had tried modafinil, because there's a subtle shift in colors that you see when you take it and they become more saturated. And every time Bradley takes the drug in the movie, the colors get more saturated. I'm like, "You guys have totally tested modafinil." I'd diverging [inaudible 00:26:37] brain well.

David:

No, not at all. Not at all. I would have loved to have done a pre, post WAVi on you with that.

Dave:

That would have been such good science, especially for taking it that long. And it was every single day 100 to 400 milligrams depending. And I tried it when I was writing the book before Fastest Way, because I wrote 1 chapter. I'm like, "God, the research on this is so good." And so I took it again and it's like a good 10, 20% boost, on par with a cup of coffee for me now. But before it was night and day. I can't function. I would have failed out of Wharton if it hadn't been for modafinil.

David:

Any downsides with it for you?

Dave:

For me? I never saw any. There's a slight rise in histamine, which is a neurotransmitter, so if you have immune issues, maybe. And you're not supposed to drink with it, they say, but well, I know a lot of people who do. And I think that's one of those abundance of cautions if you don't have a functioning liver. So for me, it was much better than Adderall, that's for sure.

Dave:

But I'm kind of bringing it back to that, that sensation of you have a fast P300V in your brain. You hear a sound, you see something and immediately, your brain is like, "I got it." And then you process it. And then there's other people, "I got it." Okay, but it's frustrating for a fast person and it's also frustrating for a slow person and calling them slow, I don't mean slow in a negative way. But just-

David:

Right, right. Become thoughtful.

Dave:

Yeah, thoughtful, there you go. So, "You're thoughtful person." And like, "Why is this person keep talking before I'm done thinking?"

David:

Exactly.

Dave:

Yeah. And I might have had that conversation with my wife who's pretty darn smart, MBA and an MD. But what do we do about that? It would, so let's say we both get a WAVi map. And then we say, "Okay, one of us is more thoughtful, and the other one is faster," whether it's a friendship or a couple or an executive team. Okay, great. Now we know this, but we still want to be at each other's throats or frustrated. What's the hack for that?

David:

Yeah, I think, well, Jung talks about the Shadow Self, acknowledging this a biggest step, so I think acknowledgement makes a huge difference.

Dave:

So, you should acknowledge that your partner is weaker?

David:

Weaker, yeah, yeah, yeah. And acknowledge that, "I'm going to try to finish my wife's sentences. And I'm half the time right and half the time wrong and finishing her sentence for her," so...

Dave:

There you go.

David:

... how are you going to stop doing that, so well, she has a fast brain, too. It's not a good or bad thing, it's just how people function.

Dave:

Exactly. It's almost look at Myers-Briggs or Enneagram, any of those systems that look at the patterns that you're likely to do. There's one called the Kolbe as well that I'm a fan of K-O-L-B-E. All of those, like

look, it's like, "Which is better, heads or tails?" I'm pretty sure having the coin was most important, but the side of the coin wasn't important.

David:

Exactly. Yeah, that's a good point. Yeah.

Dave:

So, we have to get there.

David:

Yeah, know thyself. It'd be much more peaceful world if you know yourself and become comfortable with that and then give people around you some space to be themselves.

Dave:

Yeah, it's a big deal. Sometimes, having the data can be really life changing. I was getting to the point when I was about 30. I've had a phenomenal career in my mid-20s and I ended up running technology strategy for a company worth \$36 billion and I was attending board meetings. But I was not allowed to speak until I wasn't on the board, but I was the technology expert for this company. And so I'm like, "Okay, I'm smart. I've got a job that most MBAs would like to have and I don't have an MBA. So, I'm going to go to MBA school and get an MBA because my boss had an MBA and this is what you do when you're building your career."

Dave:

So, I go to Wharton. And I'm like, "I'm going to fail. I'm clearly dumber than all of my classmates." Right? And this is an ADHD issue. And Daniel Amen's first book had come out. And Daniel and I become friends, he's been on the show lots of times. Change Your Brain, Change Your Life was the book. And I read it and immediately went out and did that inject radioactive sugar and when I walked into the psychiatrists office, he's like, "You want drugs for business school? Yeah. I've never seen this one before." And I'm like, "No, really. Something's not right." And he rolled his eyes and said, "I'll order a scan for you." But when I came in with the results, he looked at me and he said, "Dave, you have the best camouflage I've ever seen. Inside your brain is total chaos. I don't even know you're standing here in front of me."

Dave:

And when Daniel Amen saw my brain scan from that time, a few years later, he's like, "You have the brain of someone who lives under a bridge, doing street drugs. You have chemically induced brain damage." And now, a lot of people go, "Oh, my God, that's terrible." But I was like, "Oh, thank God, I have a hardware problem." I can fix a harder problem, but I want to put on your fast forward, look at the future WAVi hat and say, all right, are we going to get to the point where you go into the doctor's office, they do a WAVi scan. And then they'd say, "Okay, well, your brain is slowed down a little bit from before. Let's turn on the advanced features and get a picture of what's going on." And then, do you just go to the doctor? Do you refer to a psychologist? Do you refer to a neurofeedback, like how are we going to use all this data that you're able to get now?

David:

How far in the future are you?

Dave:

Well give me three years and give me 10 years.

David:

Let's go with the 10.

Dave:

Okay, 10.

David:

Three years, we'll be status quo in Medicine. We go in, and the doctors do what they do with this technology, and there's reimbursement for it. And they could help tweak your brain. But you haven't really developed enough of the interventions yet. So, we got to give you 10 years to really go on.

David:

So, 10 years from now, the happy path is that with the brain scan, the artificial intelligence will know you and know what you need to optimize your brain. So there won't be a question of, in the ideal world, it's not a question of your brain is slowing down. It will know you on day one and say, "This is what you need to do. As long as you stay with this program, you're going to have an optimized brain. It's not going to slow." That's my 10 year future.

Dave:

I am with you. We're both in very different ways.

David:

That's the dream.

Dave:

We're both working towards that future, but-

David:

I have an easy job because you can, there's so much information here. We will be able to get data sets put together to optimize interventions. We just need the interventions.

Dave:

One of the things that scared me forever. I mean, it is I was a cyberpunk, a real computer hacker starting when computer hacking kind of came of age and worked in the computer security industry for a while. And the dark side of technology is a real thing. So, I imagine a future where, let's see, how are the AI algorithms today used against us or for us? When they're used for us the way for instance, you go back five years on Facebook, you could teach the algorithm that you wanted to see the news articles your friends were talking about. So, my friends collaboratively filtered my news for me and it was great because I always saw the cool stuff.

Dave:

And then one day, they announced an algorithm change and they all went away and it was only cat pictures. Right? And now it's manipulative data to make you buy stuff. If there's an AI system that is changing your brain, telling you what to do to make your brain better, how do we know that it's not going to be an AI system that just makes your brain more obedient?

David:

Yeah. That's a problem. I'm just the physicist in the room. I don't know how to make these AI systems. But we have to get, it's a new technology, but it's all new and we haven't gotten, as a society, our hands around how to manage this technology. You could have imagined when cars were first invented, horrifying, planes, horrifying. All the damage that were happening, it could happen. Electricity, AC electricity was really frightening for people. So, communities had to get around this and set rules on how to make safe electricity. And we haven't created those rules yet as a society, but we will get there, I hope. We have to. We don't have a choice, because otherwise we'll kill each other.

Dave:

I'm hopeful we'll get there, too. It is a little bit chilling, though, when I heard you say, "I'm a physicist, I just make it."

David:

Yeah, no, you're right.

Dave:

I mean, I look back to Einstein's letter saying, "Let's not do the bomb or at least let's not use it, because it's going to be horrible." And it was signed by a lot of the leading physicists at that time.

David:

Right, right.

Dave:

And-

David:

Well, yeah, but you can't keep it in the bag.

Dave:

You can't keep it in the bag, so you got to build it, but also put in the ethical safeguards.

David:

Right, right. And it takes, a whole a lot of broad group of people to put in those safeguards.

Dave:

It does.

David:

The AI people won't be able to figure this out. That's not what they do.

Dave:

No, it's not their job.

David:

Asking them to do it has failed so far.

Dave:

Well, asking gun manufacturers to control where their guns are pointed is usually failing strategy because they can't.

David:

Right, right. There are so many brilliant things like these shoes by the way. It's kind of, I don't even know what they are. I was in Austin for a wedding. I didn't bring my walking shoes, so I walked around the corner and this is the first shoe store I came to, so I bought the shoes. And so, the next, next week, I was at work and the young cool people. Is that still a word? I don't know, but young people saw the shoes, "Oh, those are great, Dave." I didn't know what they were. I said, "What are they?" I don't know.

David:

So, I like the fact they thought it looked good and 30 seconds later, Erin got an advertisement on her phone for these very shoes. So, either the phone saw there's photo that was took a picture of it or somehow they analyzed my buying habits and gave her that advertisement. That was amazing. And it wasn't a coincidence. There's just no way. In the world of shoes, this exact shoes I didn't know the name of, popped up on her phone.

Dave:

That's crazy.

David:

So, it's brilliant data mining, brilliant. But frightening, too. How do they do it?

Dave:

There is something truthfulness, they're listening to you. But I don't actually know how much of that data they're using, they claim they aren't. And as a guy who started a very sizable business and has dealt with my share of regulatory stuff, the FTC controls a huge amount of power. What they can do is they can say, "Oh, you lied to consumers, therefore." And the therefore is not something you can appeal and something that can be company ending. For instance, they can say, "You must refund all money ever spent on your product," and that's a death knell for our company. And they can actually do more usually than the SEC and they can certainly do more than the FDA.

Dave:

So, I look at these big tech companies, I kind of think that, of course, they're going to lie a little bit, because well, they're big tech companies. But I think if it was and we're really listening to everyone all the time putting in our AI engine, I think that would be one of those things that might be a company

ending event. So, I just as knowing how big tech companies think because I used to work in one, I don't think they're listening all the time. I think it's amazing, amazing correlation, causation and network mapping. And I think they don't know how they're doing it because it's all, it's in a big automated complex system. Sound like a good theory?

David:

Sounds like good theory, I'll go with that. I was just amazed and it was brilliant.

Dave:

It is.

David:

But uncontrolled, that's the problem.

Dave:

It is a huge problem. And so, I'm very hopeful.

David:

We got to do it for our brains, because we have to get there. And we got to figure out, I know how to do it ethically, but that's just me.

Dave:

Keep talking about the ethics, because it's very important when we're talking about, it's different than freedom, which is supposed to be in the Constitution and all that. But we're talking about cognitive liberty, where if you use a system, and they say, "Oh, this system is going to make you smarter," and it actually just makes you better at buying crap, right? And throw awesome things you didn't even know you had, that's probably bad.

Dave:

So, my hypothesis would be, you know what we ought to do? We ought to let you set the endpoints for the AI system. So, here's the goal, AI told me how to get there and if you get to set your goal, that's cool, right? But if someone else is setting the goal, that's not so cool. And then all you have to do is worry about bad actors where I said this was the goal. And like, "Yeah, you think that's the goal, but we put it over here because we wanted you to be one of our drone CIA plant killer," insert Tom Clancy novel here.

David:

And I'm not sure that those markers even exist, by the way, to be able to get you a better citizen. For us, we focus on the simple brain speed, brain voltage, those two things, for example. That's a pretty simple point, to try to optimize-

Dave:

Yeah. Well, people with low voltage are probably easier to control.

David:

I don't know.

Dave:

No?

David:

I don't know. I don't know. My voltage isn't as strong as yours.

Dave:

My brain is weird.

David:

But I can't, I'm uncontrolled.

Dave:

But if you're at, at least what I've seen at 40 years of Zen, people have very low brain voltage or very low, other brainwaves in certain parts of the brain, they tend to be, they tend to get stuck on stuff, right? They can't overcome a challenge because it's a less resilient brain.

David:

Yeah, yeah, that's true.

Dave:

And I believe, the more electricity and the more resilience we have in our brains, well, the harder the control we have, the more dangerous we become. And being dangerous is great because it doesn't mean you're going to do anything bad. It just means you have the energy to do something bad if you wanted to.

David:

Right. And it takes energy. That's with the P300 voltage is energy. It's the reserves that you have. Yeah, so I see that a lot people that just, well, look, concussed brain. Concussion to the brain has a really low voltage and they just don't have the energy to do anything, right? All their energy is going into repairing their brain.

Dave:

And you see that with Lyme, you see that with toxic mold, you see that with Epstein Barr, you've probably see that in post COVID. It wouldn't surprise me.

David:

We've seen that.

Dave:

You have?

David:

Yeah.

Dave:

So, you've seen low voltage in the brain post COVID?

David:

Absolutely, yeah.

Dave:

And you'd see it post, almost any infection.

David:

Chronic fatigue, we see it. Pain, we see it in pain. Addiction, actually. Opioid addicts actually have really strong voltage.

Dave:

Really? Why is that?

David:

It's something about opioids. Maybe that's why they like them. It's a mixer, it gives them a lot of energy, a lot of brain energy.

Dave:

Of course, that would and if you have chronic low brain voltage, low energy, which I did, because I had chronic fatigue syndrome from the toxic mold, which is a primary cause, but not the only cause. And man, anything that would give me energy, it's just so precious when you're running at 10% of where you're supposed to be. Yeah, so I could really understand that if I'm sure if someone had offered me cocaine or something back then and I had been dumb enough to take it, I would have just said, "I can get through the day." And Of course, six months or five years later, I may not like my life. But I can see that. Okay.

Dave:

Do you think that Science and Medicine have become too conservative?

David:

I don't know. I hope not. I'm kind of, my instinct is that it is. I heard, I read a nice article from a dean, a Harvard dean, lamenting the fact that all the students were now had never failed from even elementary school, right? They're groomed to go to Harvard. No failures on any tests. And so, if you haven't failed, you haven't explored, you haven't experimented. That's why I like a lot of stuff you're doing. Let's try it. I think it's a sticker, if we're going to talk about it.

Dave:

Let's just try it.

David:

And he's lamenting the fact that his students didn't know how to experiment and explore. And he said, really, in this article, his conclusion was, "All they can do is become consultants and bureaucrats when they're done with the Harvard education." And that was, it's kind of sad, but it's easy to change.

Dave:

It is, it is totally true. I did once hire an exec in my career, who had never failed from one of the big name schools you mentioned. And when you've never failed, when you are failing, you'll be unable to see it and you'll tell yourself you're not failing. And that can be a company-destroying event.

David:

Yeah, yeah or you won't want to push your boundaries to fail, like any sports that one does. I took up mountain biking when I was old, not old, but you know, older.

Dave:

Oldish.

David:

Oldish. And I took up skiing when I was a young kid, so I can do ski really well. But mountain biking, I don't know the boundaries. I don't push them because I don't want to fall or get hurt, so I never did really well on the mountain biking. I can go uphill, fine. I can't go down. It's horrifying. But yeah, to get good, you have to fail. You've got to fail.

Dave:

Yeah. I've been working on that with my kids a lot where I praise them for working hard, but not necessarily for success. Right? And when they fail, even at night or going to bed, "Tell me something you failed at today." And-

David:

That's great.

Dave:

And if they don't have anything to say, maybe tomorrow can be a better day.

David:

Better day.

Dave:

Because that means you pushed yourself and I hope they landed-

David:

I learned something.

Dave:

They're getting old enough that it's less than it was when you're five or six, but maybe the programming landed. I don't know. Do you think we'd ever be able to see that in their brainwaves?

David:

No.

Dave:

Like a failure, tolerance to failure?

David:

Well, yeah, maybe. Yeah, sometimes, you can overrate.

Dave:

I bet we could.

David:

Overrate what is in the brainwaves because everybody is so different as outcome. But yeah, maybe an artificial intelligence could find the pattern. I don't know.

Dave:

I suspect we probably could find people who are afraid of fear. In fact, I bet there'd even be a clamping down with certain brainwaves in certain in vision, sorry. When you're envisioning certain things.

David:

Yeah, possibly. Yeah, if you did a task, you could certainly see it. I give you a task and then measure the brain response to the task.

Dave:

Even like a Stroop test or something.

David:

Yeah, something like that.

Dave:

So, guys, what we're talking about here Stroop test, getting a bit nerdy on you here. The Stroop test measures how long it takes you to come up with an answer in a situation that required cognitive thinking, which is different than WAVi because this requires an active task. There's all kinds of things like this that are out there, that are available data for our brains, and you'd be surprised if he did a test like that. A, that you can train the brain to much more quickly do that sort of thing, but B, you might be surprised that invisible, but clearly measurable inhibitors to your performance that someone installed in your brain at some point in your life. Accurate statement?

David:

Yeah, that's interesting. Yeah, interesting way to put it. It's amazing to see these things on the brainwaves. I'm still amazed when I see that the voltage, between voltage. It's subconscious and there it is. You just see it like clockwork in the brain. And Stroop test, all these. There's an arachnid test. You show people spiders and puppies and a mountain then seeing the spider in the people that are afraid of arachnids, you get this big voltage response to that. And this is all subconscious.

Dave:

It's all subconscious. So, there you go, is-

David:

A quasi conscious.

Dave:

Quantifiable difference in people who have arachnophobia, so it's not craziness.

David:

It's not craziness.

Dave:

Your brain does that and maybe you can change the brain. In fact, I'll say that you can't. One of the things I found that was interesting at Daniel Amen's Clinic was he had me do a test where you look at angry faces and happy faces, and then click a button angry, happy, angry, happy. And I'm like, given that I had Asperger's Syndrome for a lot of my life and certainly ADHD and facial recognition is okay now, but not great and it used to be zero.

David:

Really?

Dave:

Yeah. I didn't know the names of the people in my classes as a kid. Even by the end of the year, I would know five people's names. Everyone else was like-

David:

A blur.

Dave:

Yeah, brain soup. Anyhow, so I'm like, "Okay, given all that, I bet I can get most of these right." And that's great, you got 90% right, but you responded to angry faces three or four times faster than average. So, exactly what you're saying. So, that's some ADHD or Asperger's. But basically, that's probably coming from bullying, right? And you said you saw that in a lot of people who were bullied. But how would I ever know that was happening unless you did an activity, and you got the data.

Dave:

And so, it's my hope that as we move the industry forward, WAVi is going to have one of the biggest datasets of anyone, right? Because you have these things in lots of places where you're just using it on a regular basis. We can start looking at that data set and correlating with other stuff. For me, I want to find the best performing people, the gurus and meditators, a lot of them do come through, people started big companies. They'll come through the neuroscience very small scale, the thing that I do.

Dave:

And then say, "What do those types of brains have in common?" And then be able to compare them to a broad average, which I think you guys are going to have. And then use AI in whatever else, right? How do we improve consciousness and people as well as intelligence or increasing or decreasing P300V, whatever, wherever you want it to be? Is there a case?

David:

What are you trying to do? Yeah, that, what are you trying to do? Yeah, I always think, maybe in the side, then may not, the, you say, consciousness, I'm interested in contentment. In contentment gene because-

Dave:

Tell me about that.

David:

Well, I don't know how we would optimize that, but what are the content people. Right now, we're not programmed for contentment as much, right? We're programmed from the survival, but eventually, we have to become content with our surroundings or we're going to... this is my opinion. I could be totally wrong. We're going to keep consuming resources and destroy ourselves with our lack of contentment. That's out there. I may be wrong, but I'm sort of feel some of that lately.

Dave:

There's a Buddhist side of that, the hungry ghost realm. Where no matter what you eat, no matter what you have, you're not happy, and that's not good. But if you're programmed for contentment, then it's okay. The UN, the new food mandates they're trying to put in place and this is actually really happening. They're saying that everyone on the planet gets one bite, I think it's 4 or 6 grams of red meat per day and that's it and you should be content with that. And we're going to put a tax on anything that's regenerative agriculture of \$1.60 a kilo, but no tax on industrially raised animals. So basically, everyone's going to get one bite of hamburger from their favorite fast food place and that's that and we can all be contented with that. So, I don't want to program contentment.

David:

Yeah, you have a point there. Maybe it's the wrong word. But there is some contentment and a piece of it.

Dave:

Yeah, there is a happiness or a satisfaction.

David:

Yeah, we have to push our boundaries, we have to learn, but eventually we're going to have to, not have the bigger house, bigger house, bigger house, bigger car, bigger car at some point.

Dave:

100%, 100% agree with you. Right? Where you have freedom, you have happiness, right? And contentment seems like a good word for that, but when there is something that is actually not right, you're still going to have a desire to solve the problem.

David:

Right. Yeah.

Dave:

Right? To the continues to improve.

David:

Yeah, humans have to improve.

Dave:

Yeah. You can improve without buying a bigger house. And it's that word, but I don't know what that is.

David:

Yeah, I don't know what that is yet. Yeah, yeah. And how it relates to brain science, but so now, it does.

Dave:

It absolutely does, because I will tell you, the people who have mastered that have very different brains, right? Because the very small data set that I've been able to work with, you see very different patterns, right? So, someone who's in advancement of-

David:

Is that trait or is that state, do you believe?

Dave:

I believe it's probably state because when I take people who don't have those patterns and we teach them those patterns, they generally gain the state. So, we've been able to in some of our like our test stuff, we've been able to induce states that are electrically and experientially similar to taking a plant medicine. Right? So, what? With feedback, yeah, you can do that? Yeah, you can. And since they're having the experience, after we create the state, I'm going to say it's the state.

David:

The state, okay.

Dave:

Right? But not always. I'm sure some of it's the opposite.

David:

Right. Right. Interesting.

Dave:

And-

David:

That's good stuff.

Dave:

It is interesting. And-

David:

Well, what I would like to know if some of those, the people you work with is, you know there's a change right there. Everything we do changes the brain, but the default network is what I'm interested in. What are they like a year later in their default state?

Dave:

Got it.

David:

That [crosstalk 00:51:57]-

Dave:

You said default state or default network?

David:

Default network. It is still a default state.

Dave:

Yeah. Okay, but let me define that for our listeners really quick. So guys, there's a default mode in the brain and if you read probably, Headstrong, but maybe Bulletproof Diet, I wrote about this. And our default mode is kind of what the brains doing when you're not doing something, like what's going on, right? And then there's an active mode when you're doing something. And we always thought it was one or the other. It was kind of an on and off switch. And then I think it was either Cambridge or Oxford came out with a groundbreaking study maybe 10 years ago that said, "Oh, look, it's a slider switch." So, there's always a little bit of default mode going on.

Dave:

And then to your question, now that we've got context for it, is what's going on a year after someone has an experience like that? Well, that's interesting, because if you were to say take a full dose of psychedelic mushrooms, right? They've done studies six months and a year later on depression and it's better. So, it seems to create a long-lasting change in the brain. But it may be because the compound itself raises nerve growth factor and brain-derived neurotrophic factor, BDNF. And so, it could be there

was a chemical and then an electrical change, but you'll see the difference in brainwaves and something like that.

Dave:

Have you guys ever done a study? Well, you do addict work, so you must, when someone's on acid or something you can see their brainwaves or all of the waves, right? Delta and theta?

David:

Well, we've opioid work. We haven't done... we want to do a lot of those studies with the micro dosing. There's some people who proposed some micro dosing studies.

Dave:

Well, Paul Stamets, have you seen what he's come out with there?

David:

Yeah, yeah.

Dave:

I just had dinner with him. And he's talking about micro dosing mushrooms, the medicinal kind that are illegal in most of the world, plus Lion's Mane, plus some other stuff and he's started a whole new company about it because of what he's seen with brain regrowth. So-

David:

So, when you meet him again, tell him we need to do pre, post WAVis and we need to measure the default network change because we know the state changes.

Dave:

Totally. I can introduce you guys.

David:

That would be a really nice study.

Dave:

Paul is an amazing human being. He came up to my house a while ago to be on the show. And I've just, I appreciate him a lot.

Dave:

When I think about WAVi though and what we're just talking about there, you're saying what would happen a year later. I did a small sampling of people a year after doing, it's like personal development, intense meditation plus neurofeedback, so it's not just neurofeedback and it's not just imaging. And 90% of them maintained the state, right? But 10% of them drifted off and God knows why they hit their heads or ate too many mushrooms. Correlation causation, who knows? But the majority of them saw it.

Dave:

But what I want to know though is, we put on our tenure hat, there's a WAVi in every doctor's office, so they get your blood pressure, they hit your knee with a little rubber hammer. And they say, "Is the whole system working? Because if so, your brain is going to be responding about right and about like it did last time." Right? What else is going to come out of that data set?

David:

What else? Isn't that not enough?

Dave:

Well, not enough is that it? For someone who doesn't have contentment, it's obviously that.

David:

Yeah, obviously, yeah. Let's keep it simple. I think my vision is simple to say, what are your propensities? What do you need to stay optimized? To me, that's enough. That's probably all I would want in other dataset.

Dave:

So, propensity is kind of personality analysis plus how to keep it working.

David:

Yeah, keep it working, yeah. I think if we can keep it working that's a big deal.

Dave:

I already know the answer this, but just for our listeners, would you be able to say, "We think you're getting Alzheimer's and you better back off on the sugar and bad fats" or?

David:

We can probably do that now, by the way.

Dave:

[crosstalk 00:55:44] by looking your eye movement without neuroscience.

David:

Right, right, right. No, we can. We've had rewarding studies where people who have been diagnosed would fall on Alzheimer's. We'll be able to look at their brains. Our docs have looked at it and said, "I think this is not Alzheimer's. I think this could be vascular dementia or something." And so, they've been able to reverse symptoms for long term on a lot of these patients, which is really rewarding.

Dave:

That's amazing.

David:

They've got a death sentence and the doc say, "No, I refuse to believe it. Let's get intense cardio."

Dave:

A huge number of people diagnosed with Alzheimer's actually have problems with blood flow, because they're on blood pressure medications. They just have low oxygen in the brain and-

David:

Or poor hearing.

Dave:

Yeah, or poor hearing, too, yeah.

David:

We've had a couple of those cases. "Why do you think your mom has Alzheimer's?" "Because she acts like she doesn't hear us?"

Dave:

When I heard that, that makes so much sense.

David:

"Well, maybe, she doesn't hear you?"

Dave:

Yeah. Okay. I like that. Is it your hope that we'll get to the point where just by looking at brainwaves, you'd be able to see, "Is this real Alzheimer's versus low blood flow?"

David:

Yeah, that I think. Again, we can almost do that now.

Dave:

What are the neurological symptoms that you'd see on an EEG from someone, who just doesn't have enough oxygen in their brain?

David:

Yeah, so remember in this world correlation is not causation, right? So, I don't know the mechanisms. But we're starting to see a real distinct pattern of this thing called a P200. We might be wrong about this. We need more data. But it looks to me like the P200 gets pronounced on true Alzheimer's.

Dave:

And what's P200? Give me a little bit of a definition.

David:

It's a little peak right before the P30. No one knows what it means. P300 is when the odd and the rare separate. The brain says, "That's different." P200 is right before that moment where the brain hasn't separated. There's a big voltage spike, so it's trying to separate, but it hasn't quite separated it yet. And so, the P300 goes away in true Alzheimer's, what I've seen. We need a lot more data.

Dave:

Interesting.

David:

But the P200 gets really pronounced, so the brain is just confused. But on the vascular people, there's still a P300, so.

Dave:

You reminded me of something when you were talking about P200, this little spike that's doing something, but we don't know what it is. Have you ever read the book Unintelligence?

David:

No, no.

Dave:

Fascinating book. And people who were in the upgrade collective, which is my mentorship group. I've talked about that with them and suggested it as reading and the people who have read have gone, "Oh my God, my life is changed." This is a guy who did, remember the Palm Pilot?

David:

Mm-hmm (affirmative). Mm-hmm (affirmative). Mm-hmm (affirmative).

Dave:

He was a founder of the Palm Pilot company. And I remember I ran into him one time because I worked for the company that bought Palm Pilot as I was at the very beginning of my career. And-

David:

Lucrative investment, I'm sure.

Dave:

No, it wasn't an investment. I was, I just worked there. Cisco kicked our ass. Company is gone. It's called Three Com. And wow, way back in the day, company that made modems, US Robotics who bought them and they own Palm Pilot. But I'm digressing a little bit there. This guy, who's, I want to say his name might have been Hawkins, but I'm blanking right now. He refused to come on the show, because he's like, "I'm retired. I don't do any of that kind of stuff." But he wanted to be a cognitive scientist, but they didn't have such a thing, so he became a computer scientist. He invented the first handwriting recognition that worked. It was called Graffiti. It was a special character set, but it was always in the context of studying how brands worked.

Dave:

And he wrote this book. God, it's got to be 15 years old and he said, here's what the brain really does. And it's a classic book in my mind, because it's backed by Math, it's backed by Science, and it's backed by systems thinking in an engineer's mindset. He said, "Here's what the brain is doing. It's predicting the future, a microsecond in advance all the time."

David:

Interesting. Never heard of.

Dave:

And you only notice things that either you choose to notice or that don't match your prediction. And his example is if you pick up your car keys, and they weighed just a gram or two more than normal, that didn't, like the whole motor skill picking up, you didn't have to think about how you grabbed them or any of that. You just did it. But then as soon as something was off, you go, "Huh?" Right? And I think that P200 you just talked about is probably part of our predicting the future algorithm. But I don't know if that'd feel.

David:

Yeah. I think so.

Dave:

Exactly.

David:

I'm sure it's bunch of neuroscientists that will have all these opinions.

Dave:

Yeah, will know about this. Yeah.

David:

He'll say, "This is what it really is."

Dave:

They're bad people.

David:

And someone will say, "This is what it really is." Yeah, no. It's part of the system is revving up to make the prediction. The P300 is the prediction, right? It's the detection that that was off. I didn't expect that tone.

Dave:

And so, you've got to ask yourself, if you're listening to this, you just heard that somewhere between like the fastest P300V out there is what? 180 milliseconds or something?

David:

No, no, 240 is where we set the cut off to get to P200, so 240.

Dave:

Okay, so 240-ish. All right. So, somewhere between zero and 240, and that's about a quarter of a second, right?

David:

Mm-hmm (affirmative).

Dave:

Who's in charge of what you do and reality before your brain recognizes reality in a way that you recognize it anyway?

David:

That's a good one.

Dave:

Do you have an answer for that?

David:

Of course, not. But as far as-

Dave:

I do.

David:

I can see it on the voltage. You can tell me in minute. But you see it on the voltage, it's 100 milliseconds, the brain says, "I heard it." They can use this on infants to do hearing tests. And then the P200 milliseconds is doing something, but it's all seems to be on autopilot. But talk to me.

Dave:

All right. So, it is on autopilot, right? But who's running the autopilot? Well, there is a distributed network intelligence throughout the body with a quadrillion sensing nodes that can also make electricity and take action by releasing a bunch of different chemicals, mitochondria.

David:

Isn't that amazing?

Dave:

It's super amazing. And you look at emergent behavior of complex systems, which is what I studied in my undergrad and what I did when I was designing high scale internet systems when we're creating the Cloud. Well, you can make intelligent stuff happen that looks amazing from very simple rules repeated forever. And that's based on Stephen Wolfram's work, which I'm guessing you probably know about, because you're a physicist and a nerd in a complimentary way. So, what I think is going on there is that the automated system, the meat operating system that keeps us alive before we can think about stuff, it's in charge. And that's why you pull your hand away from a hot stove before you can think about it.

Dave:

And here's a question for you. You might not know the answer, but if you do, I'm so excited. Does the body move before you see a P200 or a P300 if you lean on a hot stove? I think it does.

David:

Absolutely. We measure that all the time.

Dave:

Good. So, who's moving the body before the brain knew what was getting burned?

David:

We just call it the reptile brain. That's all we-

Dave:

But is it actually the brain or is it a local network?

David:

It's the whole network, right? Isn't that what you mean? I think it's the whole system.

Dave:

It's a local network that rolls up into the system, but the hand felt the pain. You had substance P, you had an electrical thing, and the hand is like, "I'm going to save me." And the hand is independent of the body from a computer architecture thing. Because this is the only way you can build the internet, right? Everything can't know everything because a real size map of the US isn't useful because it's as big as the US, so you have to have local intelligence in any system. And we've seen this over and over in cryptocurrency in the algorithms there. We see it in network architecture, where you distribute routing tables, and this router makes the decision. And eventually, it tells you someone else what it did, but it had to make the decision right now.

David:

Yeah, but I'm wondering with quantum-

Dave:

And I think our bodies and our brains are doing that.

David:

You might be right. I don't know nothing about this. With quantum systems though, the now is instant, right? So, the instant you touch this stove is the same instant the brain catches it, so there are entangled states, so.

Dave:

This is why I love talking with a physicist. There totally could be quantum entanglement between, in fact. God, because with quantum biology, I bet you there's someone who studied this. I got to find him, not like a Bruce Lipton or somebody. He's one of the first guys to talk about it.

David:

Easy to speculate, hard to measure.

Dave:

It's probably measurable, though because if there's quantum entanglement between all of the mitochondria or most of them, that would describe a system that's way faster than 100 milliseconds or 20 milliseconds. That'd be an instantaneous system and we don't have that.

David:

I don't know if we don't have that.

Dave:

Interesting.

David:

Because 100 millisecond, this is all the brain voltage, right?

Dave:

Yeah.

David:

But we see the reptilian stuff happen and totally independent, which-

Dave:

Wow. Okay.

David:

So, your reaction time is not at all related to what your brain, what we measure your brain to be doing.

Dave:

This is the fascinating stuff. This is why you transitioned from looking at the hardcore physics stuff into brains. It's why, for what, seven years now, I've been doing 40 years of Zen, partly, but also full disclosure, because I needed to tune in performing on brain. Just sort of like you have a Formula 1 team, you should have your own mechanics. I have mechanics for my own stuff, but I just wanted to share it for people who felt called to that. And the more I dig deep, the more I get a chance and to talk with you and to talk with leaders in the field that there's a lot of work to be done.

David:

A lot of work to be done.

Dave:

Like a lot of work.

David:

Yeah. It's the Wild West, really. Is that a bad term? Wild West?

Dave:

I don't think so. Do you see WAVi publishing clinical research or public like opening the data set for analysis by multiple people, anonymized, things like that? Sort of what's your view on anonymized brain data as a human resource?

David:

Yeah. Well, you talked about handwriting samples, there's a famous handwriting data set that the US Post Office published open. And it was to allow the community to solve that problem for them. Handwriting is hard, right? How do you take 100 million letters addressed to people? Everybody writes differently. So, they gave up on, this is the correlation, they gave up on the causation. What does an R look like? They gave up.

David:

So, they published the data set and had people analyze it and sure enough, their results improved drastically despite the machine learning, despite artificial intelligence community. To get so many Rs in the algorithm was better than a human would be.

Dave:

Wow.

David:

And so, that's the way I see brain data going. I'd like to see it going that way, so we open up all of our datasets. We publish them to see if people can beat us. We got this, one proposed. I don't know if it's a proposal as part of the opioid settlement. Hope it goes through. It's a great one. And to do that is to classify addicts versus non-addicts versus people in pain. And just open up the data set to the machine learning community...

Dave:

Wow.

David:

... to see who can have an award, who can beat our results. I think that'd be kind of fun. But again, like you said, there's a dark side, that we're going to find out what it is.

Dave:

It can help people as long that was in the hands of kind people with full transparency. If you look at the signals that were coming out of both of our brands, and we could sort out the eye blinks and the jaw tension, because unfortunately, for our listeners, when you're doing EEG readings of the brain, your muscle activity, if you move your head, or you wiggle, it overwhelms the signal of electricity and AI can I think helped to get some of that out, but there's still some data that's lost.

David:

Yeah. That's why the eyes closed resting protocol that we use is a lot cleaner. Once you start giving people tasks to do, you have a lot more problems with that.

Dave:

You really do. And then there's a bunch of, "What were they thinking about what they're doing?" But if we were to look at our brainwaves, and we could clean all that crap out while we're having this conversation, what correlations would we see with your brain state and my brain state?

David:

See, that's a frontier did. David Jaffe, our Chief Engineer. He's brilliant, invented the pulse oximeter. And he claims there are some studies out there where people's brains are sort of entangled, if they're like couples will be in different room. I haven't seen those studies, so I don't know. But really interesting stuff to think about.

Dave:

I haven't seen brain entanglement. There's definitely heart rate variability things and these come from the Heart Math Research Institute. I was an advisor at the Heart Math guys in the late 2000s. And we know, well, the strongest one is actually between horses and humans. And when a human walks into a stall with the horse, the horse's heart rate variability will change to match the human. And this is why-

David:

I haven't seen that study.

Dave:

It's real stuff.

David:

I got to tell my wife. My wife boards horses. I got to tell her. Really?

Dave:

What's his name? McCready, Colin McCready. God, it's been a long time since I talked to him. I believe, yeah, he's the guy who led the research. And it was very clear and this is why and everyone who does therapy with horses knows that you put someone who's anxious and tweaking on a horse, they can't ride the horse, because the horse is anxious and tweaking, so the horse is a mirror of the person. Well...

David:

Yeah, yeah. We do see that.

Dave:

... they've got data that humans are married with humans, and the person with the highest amplitude, heart rate variability, whether it's chaotic orderly is entirely different, will take over a room. And in my view of the world, the reason that casinos can bring in the downer guy when someone's winning at the table, that's a person with high, high amplitude signal there, but it's a chaotic signal. So, you can take people out of the sympathetic or parasympathetic and put them into more sympathetic.

David:

The question is, is it the heart rate or is it some other social stuff going on?

Dave:

There's huge correlations between heart rate and they actually did some stuff, like some of the studies were pretty clean around not talking and stuff. But if you assume that the magnetic field around your heart affects someone else's, then okay, we know how a variability in brain states. There's a high correlation of alpha and all that stuff, so there is some kind of an effect that we would have measurably on each other probably because we're also vibing on cool topics, right?

David:

Right, right.

Dave:

But I want us to be able to get that signal and say, "What's going on with us?"

David:

Yeah, that's weird. There's another, a weird one, too. He tells me about. So, pre-ponse, which we've got. We got to do this measurement because I believe it's impossible, but the idea is that I do an image where I get your brain response. There are some studies that he talks about where your brain responds the signal to the stimulus before stimulus happens. So, and I think they did it with a car wreck or something. So, I'm going to show you a car wreck and I can get the brain response from that because it's a graphic, but there's a signal before I even show you the picture, which is very strange.

David:

And it's not, and you can do it with some make sure the statistics are good that it said that it's really is responding to the pre-car accident. Because you have much of the placebo pictures of puppies and all that. I don't know if it's real, but if it's real that yes, that's, I think, one of the first demonstrations of a quantum state because quantum states do that all the time. There's a delayed choice experiment, where the electrons or photons know what the system is going to be before it happens. And so, we see that pretty commonly because time becomes this variable in our final equations, but we've never seen it on a macroscopic scale, on a human. So, yeah, maybe in the next 100 years people will really, that'd be amazing.

Dave:

There's an old book, and I'm blanking on its title. And it's from the guy who invented neurofeedback. I think it was Joseph Comeau, but I could be wrong. And the experiment they described was they used a random number generator, and this was after a bunch of other pre experiments. And so, no one in the room could know whether you're going to see a car accident or a puppy. And when a car accident was going to show on a screen for someone, before it showed up, the person's nervous system would basically clamp down and they would see a change in the brainwaves. But if it was puppies, they wouldn't see the protective change. And if that is possible, and I'd replicated it myself, and I don't know it, it casts doubts on everything we think we know about ourselves in reality, we're just going to skip it.

David:

Yeah, yeah, space, time, everything goes out the window. Which is why I'm skeptical, but let's do the experiment, right? I mean, we talked about science being too conservative, why not do that experiment? What a great one if it's false, that's fine, but we got to find out.

Dave:

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It seems like the most important experiment we could do, right?

David:

Yeah.

Dave:

And if you look back at the Enlightenment, you look back at the history of science, they were always trying to unpack Mother Nature, right? Trying to understand how does it work and one of my favorite pieces of art at my alpha labs in my house where I normally record the show, is a painting, I think 14th Century, and it's an alchemist with all the weird buckets and stuff alchemists had. In conversation with Mother Nature, so it was wearing the alchemist outfit with robes, where it was now a lab coat basically. And then Mother Nature is this kind of semi-nude female with vines coming out of her hair and all this stuff, and they're having this conversation about science versus nature. I think we're still doing that.

David:

I hope so.

Dave:

I hope so, too. I also hope-

David:

Yeah, let's do it. But go on, go on.

Dave:

I have the data set that you're getting from WAVi is going to provide some enlightenment to that exact conversation. Because when we have enough data, unless someone goes in and manipulates it, so they can sell something and as long as it's real data, we're going to learn a lot about the human condition from brainwaves and not just a few brainwaves, but from a lot of brainwaves. And doing that in a medical setting, saying, "How are you doing?" I think it's really brilliant, but the side effect of that could be transformative. So, I'm happy to have been able to have this conversation with you, David, thank you.

David:

Yeah. That's why we're doing it.

Dave:

Well, this is intriguing technology. If you're a researcher, you run a clinic, you're a doctor, and you're interested in getting a brain score so you know how the people you work with are doing and at the very highest levels. Is it working? Is it not working? Especially in functional medicine, I think this is really cool. Go to wavimed.com, use code DAVE and they'll give you a discount because I always ask people to come on the show to do that.

Dave:

And this is a piece of clinical grade gear, but it's really intriguing and to be able to get an understanding of what's happening inside a person's brain quickly, and without all of the goopy stuff in their hair and without being a neuroscientist. Just like you would with a blood pressure cuff, but you don't even need

to do it with a stethoscope because it's all automated. It's like that but for the brain. That's wavimed, W-A-V-lmed.com. Use code DAVE.

Dave:

David, thank you for a fascinating conversation. And anytime I get a chance to talk with someone who said, "I became an expert in this field, and then I went sideways to that field," it's always so interesting. And the fact that you took your physics brain from hard physics and brought it over to neuroscience, I think it's going to yield a lot of really cool results over the next many decades that you'll be alive.

David:

Well, thank you. And keep doing what you're doing.

Dave:

Yes, will do.

David:

So, I can get those decades.

Dave:

Guys, thanks for listening in. There's going to be a few more episodes recorded here at the Biohacking Conference. And, man, the world's getting to be a really interesting and fun place.