

FORCE learning and finding an out with David Sussillo

The senior research manager at Meta Reality Labs talks about neural networks and his time at the Milton Hershey School.

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This transcript has been lightly edited for clarity; it may contain errors due to the transcription process.

[opening theme music]

Brady Huggett

Welcome to Episode 8 of “[Synaptic](#),” our podcast that investigates the people, the research, and the challenges of the neuroscience field, and welcome to *The Transmitter*— that’s our new name. We have relaunched *Spectrum* as a media outlet focused on the entirety of neuroscience, and now I work for *The Transmitter*.

[transition music]

OK, before we get to today’s episode, a little more news. I haven’t had a chance to relay this yet, but “Synaptic” won a Signal Award. That’s the annual global podcast award sponsored by HBO Max, Podglomerate, Pod People, and a few others. We entered Episode 3 of “Synaptic” with Ashura Buckley in the science and education category, and the judges picked it for the gold. I was definitely surprised by this. We’re a new show, and that was just our third episode, and we’re not Gimlet or “Serial” or Wondery or any of those big names, but we won the gold.

Anytime a new interview show wins gold for a single episode, you have to just point to the guest. Ashura Buckley gave an open, warm interview, and she said smart, thoughtful things, and that, apparently, is how you win a Signal Award. If you haven’t listened to the Ashura Buckley interview yet, go to the archives. She is Episode 3. There you go. You’re now listening to an award-winning podcast.

OK, for today’s show, let’s start in Albuquerque, New Mexico, around the mid-1980s, and let’s specifically go to the Albuquerque Christian Children’s Home, a nonprofit ministry meant to help children in need, to provide them shelter, food and guidance, including spiritual guidance. It’s on the west side of Albuquerque and sits on six acres of property. The children there live in cottages, and each cottage has a set of house parents that oversees it. The ACCH, as it’s called, housed its first child in 1970, and over the last 50-plus years, it has provided care to around 600 kids.

Now, it’s called a home, or a group home, but it could also be called an orphanage, and David Sussillo spent formative years there. That’s today’s guest, David Sussillo. It was in ACCH that David realized he needed to find something that could lift him out of his situation, and he began to think, began to consider his talents, specifically looking for something he could use, and he realized that what he had was his intelligence. That was his gift, and that would be the thing he’d use to bootstrap himself, as he says, to a different place. We talked about that in his podcast.

We also talked about his time in the Milton Hershey School, a boarding school for kids who have demonstrated resilience, as its website states, though it might also be described as a place that takes in children in need. We talked about writing the Sussillo-Abbott paper as a Ph.D. student, and how that changed David’s trajectory, and we talked about neural networks, and doing neuroscience research in industry versus academia, and how those differ. All that coming up in the next hour and a quarter. I recorded David at his home in California on September 27th, 2023. It was a warm day, sunny, in the low 70s.

He lives on a quiet street about 10 minutes from Stanford, so quiet that mobile phone service drops away as you wind toward his address. His house is earthy, I’d say. It’s warm in color, with wood tones inside. His house has a fence around it and a nice garden. There were some birds in the trees of his garden, which you can actually hear in the recording, and also for a bit, someone doing some landscaping until we got up and shut the windows. Let’s pick it up here, where David is telling me how he made his way to California. Here is your “Synaptic” episode with David Sussillo, starting right now.

[transition music]

David Sussillo

I've been here for, let's see, 2011, so 12 years. I finished my Ph.D. with Larry Abbott and was wondering what to do, and so it seemed reasonable with Krishna Shenoy and Mark Churchland that some of the things that Larry and I were thinking about would be reasonable to apply to some of the monkey movement datasets that they were generating. I actually came out here for a two-week trial, because I'm a computational guy. Everyone in those labs are really experimentalist; I don't mean to pigeonhole people. They just wanted to see if it would work, and within a week or two, we were like, "Hey, we can really apply these things." Based on that initial experience, my wife and I moved out here, and I joined Krishna's lab in 2010, almost exactly 13 years ago.

Brady Huggett

Oh, OK. Because I thought you had come out from Google. All right. Let's go back to Albuquerque.

David Sussillo

Yes, sure.

Brady Huggett

That's where you were born, New Mexico.

David Sussillo

Yes. That's right. I was born in Albuquerque, New Mexico. As is well known at this point, my parents were both drug addicts.

Brady Huggett

When you were born?

David Sussillo

As far as I know. [chuckles] I knew my parents for a few years, I knew them as a young child; I lived with them. That became untenable. Eventually, I and my sister, we moved to an orphanage, a group home called the Albuquerque Christian Children's Home.

Brady Huggett

Are you the second born?

David Sussillo

I am, yes.

Brady Huggett

You had an older sister?

David Sussillo

I did, yes.

Brady Huggett

OK. When you say it became untenable?

David Sussillo

Let's see, my father left, and my mother became mentally ill, so she went to a hospital.

Brady Huggett

How old were you?

David Sussillo

That would have been 7 or 8.

Brady Huggett

Oh, so pretty young. Pretty young.

David Sussillo
Definitely. Yes.

Brady Huggett
You were in a family home, maybe not that stable, but a family home until you were about 7 or 8.

David Sussillo
That's right.

Brady Huggett
Whose decision was it for the orphanage?

David Sussillo
That's a great question. I think it ultimately fell to my grandparents. There was a question of whether or not they might take us in, or we might be adopted, but neither of those happened so we went to this place, this orphanage.

Brady Huggett
This is your mother's parents?

David Sussillo
Yes, my mother's parents, that's right.

Brady Huggett
Were they in Albuquerque?

David Sussillo
They were, yes. I knew them well, actually. We would go over after, or to go to church on Sunday, and then go out to Furr's Cafeteria or someplace for food.

Brady Huggett
You had a family environment around you.

David Sussillo
I did have a family environment around me until about, yes, 6 or 7. That's right.

Brady Huggett
These early years, 7 or 8, were you aware that your parents were troubled, that your mother was a heroin addict, your father was a heroin addict?

David Sussillo
I had no idea.

Brady Huggett
No idea?

David Sussillo
Yes, no. I think kids are really oblivious to this stuff. I was. Obviously, looking back, I can think about behaviors that didn't quite add up. If you've only known one thing your whole life, and you're a kid, it's not very confusing. It's like, "Hey, I'm just doing my thing here."

Brady Huggett
Yes, there's no comparator, really.

David Sussillo
Yes, exactly. That's right. That's what it is.

Brady Huggett

OK. I'd heard that you've gone into a home. At 7 or 8, you go in. Did your sister go in with you?

David Sussillo

Yes, she did. That's right.

Brady Huggett

Were you able to keep that tie?

David Sussillo

A little bit. She and I never had really anything in common. At the group home, there were three different cottages. Cottage 1, 2 and 3. Oftentimes, we weren't even in the same house. I don't know exactly why that decision was made, but it was probably because interactions with the house parents are really fundamental. If you don't get along with them, life is hell. If you get along with them, life is decent. That could have been some of the reasoning there. Honestly, my sister and I grew apart in that orphanage.

Brady Huggett

Because I would have thought that you would have bonded.

David Sussillo

No, it didn't work out that way.

Brady Huggett

Ah. OK. What was, if you don't mind me asking, life like in this home?

David Sussillo

What was it like? Oof.

Brady Huggett

Here. Maybe I'll start with an easier question. How large?

David Sussillo

Sure. I see. Yes, I can give some descriptions. It was three cottages. Cottage is really misleading because these were 6,000-square-foot ranch-style brick homes. Each could hold 20 people, including a set of house parents and their couple of kids. On any given time, back in the '80s, there was a lot of people there, a lot of kids, rather. We probably had anywhere from 30 to 50 kids on any given day. A lot of what goes on there, it's meant to be transient. Nowadays, people understand that orphanages are a pretty terrible idea. The foster care, fostering as a way of handling some of these societal problems, is much more preferred than just putting kids in an orphanage.

It was meant to be transitory, but for my sister and I, it was not. We were there for five years. You got to know some kids who were, we informally call ourselves lifers, who had been around a long time. A lot of kids, I look at some of the pictures that I have now, and I don't even recognize them. They're just part of the in and out and the tapestry and a sense of really constant flux and constant change.

Brady Huggett

They're coming in and out.

David Sussillo

Yes.

Brady Huggett

Versus, I know you weren't there for your life, but a lifer. Five years would be a lifer.

David Sussillo

Yes. Also, I ultimately ended up at Milton Hershey School, which is a very, very large, glorified, wealthy orphanage.

Brady Huggett

Yes, so some kids were leaving. Were they returning to their parents, or were they adopted out by new parents?

David Sussillo

I have no idea. I think adoption is pretty rare once you get to be 7 or 8 or 9 or 10. There's clear behavioral problems that accrue from the kind of life that I had as a kid, and my understanding is that's pretty clear to adults, and a lot of adults really want that malleable cherubic young baby. Yes, exactly. I would imagine that they found ways to other family members or back to their parents, I guess.

Brady Huggett

You were in there for a good amount of time. You said you were about 7 or 8 when you went in, so this takes you up into your being your teenage years.

David Sussillo

Yes, my teenage years. That's right, and so what happened is my mother passed away. It's a funny thing because a mother is obviously very important and special to the relationship with a child, but my mother was very sick; she was in and out of a psych ward for five years and contending with issues related to addiction, so when she passed away, it actually in some sense gave an opportunity for my extended family to get involved because my mother was no longer there anymore. Yes, exactly. They feel like they can actually get involved.

Brady Huggett

They may have wanted to get involved before, but there actually was a parent around, so they're like, "It's not my place."

David Sussillo

Exactly. Yes, there's a little bit of that. Exactly. What happened is I went to live with my aunt and uncle in Maryland.

Brady Huggett

In Maryland. OK. At 13 or something.

David Sussillo

Let's see. Yes, exactly at 13.

Brady Huggett

All right. From these early years before you were, what'd you call it, AC —

David Sussillo

ACCH, Albuquerque Christian Children's Home.

Brady Huggett

Was your relationship with your mother strong? Was the loss of her —

David Sussillo

I think it was. That's a complicated question because if I look back at the real trauma of my life, it was going to the orphanage in the first place. I think there might have been that sense of loss in slow motion over the five years that I was there. Also, the emotional aspect of living in a group home is such that you become very desensitized.

After living there for five years, I don't know if I would have even said I loved my mother. Don't get me wrong, I loved my mother, but it's a very tough place to live. To state the obvious, a lot of kids don't really survive that experience. They don't really make it in life. Yes, it was a loss when she died for sure, in the way that I experienced, it was not so much in an emotional feeling. It was through behavior. My behavior became very, very poor, especially in school and especially around teachers who were women.

Brady Huggett

Oh, interesting.

David Sussillo

Yes, exactly. I was getting kicked out of class essentially constantly, and the threat of expulsion was the thing that ultimately corrected my behavior.

Brady Huggett

I should ask, is the schooling happening in the orphanage, in the group home?

David Sussillo

No, actually. We went to public schools.

Brady Huggett

You would go back and come back [crosstalk].

David Sussillo

Yes, so we went to public schools. I was in a middle school called John Adams or something.

Brady Huggett

OK, so this idea that you said was like a slow loss of your mother's. For five years, she was not around. Did you see her at all in that period?

David Sussillo

My mother actually cared. She really did care. She would try to take us out and take us back into her life, but she couldn't do it in the neighborhood we were living in. It's actually known as the War Zone. That was not a great place for kids, so between those two things, it was just hugely unstable. I think everyone realized, including me, was like, "Oh, I'm probably just better off —"

Brady Huggett

In the home.

David Sussillo

Yes, exactly.

Brady Huggett

She'd take you out for a week or something.

David Sussillo

Yes, exactly.

Brady Huggett

All right. This is like a slow loss of the mother figure, and then she dies. It's not like a [crosstalk].

David Sussillo

It was totally unexpected, by the way.

Brady Huggett

Oh, it was.

David Sussillo

Yes, she died of a medication, except I believe, or something — The right way to say it is she died from the complications of addicted life and all the things that she was going through. There was a physical reason, but anyways, let's say she was a ball of yarn that was hard to disentangle.

Brady Huggett

Yes. When you begin to act out, do you think that's because — suddenly, there was no hope. She was not coming to try again to get you out of there, then it was like, "Well, this is it. I'm on my own."

David Sussillo

Maybe. It's hard to put a cause behind some of it. The thing I understand about —you're a kid so your mind is developing as all of these things are happening around you that you have no agency about. I have no agency where I'm living, I have no agency about my house parents. House parents can be good house parents; they can be less good. I have no agency about what's going on with my core family, I haven't seen my father in so long, so because of that, I would say that it's very hard to say what was going through my mind. I was just simply adapting, or maybe in other words would be surviving. That's honestly how I would think about it.

Brady Huggett

OK, so around 13, she dies; you begin to act out. They do expel you from school?

David Sussillo

They do not. No, no, no. The threat of being at the ACCH all day long, alone in my room with detentions was enough to keep me at least on a level of behavior that was not expulsion.

Brady Huggett

Was the house that terrible? For some reason, I'm thinking, "Well, it's not 200 kids." Your face is telling me it was terrible.

David Sussillo

It's hard to explain. It's like living with a low-grade fever. I keep saying it's hard to explain because imagine if you didn't have parents; imagine if you didn't feel love; and imagine all the kids around you also don't have those experiences; then everything is one step away from "Lord of the Flies," and Piggy gets a rock in the head. It was an emotionally unsafe place. If your house parents weren't great, then all of a sudden to —

Again, these house parents are really doing really impossible work, and they want to be there; for them, it's a mission. The Albuquerque Christian Children's Home, these are practicing Christians, but from this perspective of a child, the view is very much, "This is an authority figure and I don't want to be under the thumb," and all of that kind of thinking.

Brady Huggett

Right. It's not as if they're surrounding you with love, because they're overworked, all those things.

David Sussillo

It's all about the ratio. The answer is yes to your question. You do not feel surrounded in love, because if you have 16 kids to 2 house parents, I'm sorry, the math doesn't add up. That's really what's going on.

Brady Huggett

Then you said a low-grade fever. I'm sure that you weren't, well, I'm not sure of this, but there's always a threat.

David Sussillo

It felt that way.

Brady Huggett

Even if it isn't even happening every day, there's always a threat. Some other kid may come after you.

David Sussillo

Something like that.

Brady Huggett

You just feel unsettled; you don't feel secure.

David Sussillo

Yes. I want to be somewhat nuanced here. It wasn't like I was in fear for my life every day at the ACCH. That's definitely not the case, but you develop an emotional stance where you're the only one that's taking care of you, and you're not thinking that because you're a kid, that's your stance. We couldn't leave the group home because of insurance reasons. We were on this little plot, five acres of dirt in the desert, so there's nothing to do most of the time. It's just not a great place. It's not

stimulating. It's not intellectually stimulating, it's not emotionally stimulating, and so yes, that's why I didn't want to spend my days expelled, in my room.

Brady Huggett

Right, so you're, I'm going to say, now walking the straight and narrow at school maybe for the first time. I don't know. Something like that?

David Sussillo

Ish.

Brady Huggett

You're with your grandparents.

David Sussillo

No, I'm at the group home.

Brady Huggett

Well, you said after your mom dies, some family members stepped in.

David Sussillo

Oh, yes, my aunt and uncle did. Yes, I moved to the East Coast, and everything's different, and I wanted to make that work, ultimately. I lived with him for about a year. It didn't work out, but it was like, "Hey, I'm out of the group home, and let's give this a shot." The thing that I remember really was like, "Hey, it's one kid to two parents. That's pretty cool." I just remember the environment being much more intellectually rich. Like I said, it didn't work out, so ultimately I went to a boarding school called the Milton Hershey School which is —

Brady Huggett

Hershey, Pennsylvania.

David Sussillo

—Hershey, Pennsylvania, yes. If you've ever had any Hershey's chocolate, you were funding the world's largest orphanage. Milton Hershey and his wife Catherine couldn't have kids, and so they left literally all of their money to a small orphanage in 1906 or 1909 or something.

Brady Huggett

Wow.

David Sussillo

That was \$60 million back in the day.

Brady Huggett

That's a lot of money.

David Sussillo

\$15 billion today, so this school has an endowment that's like Harvard- or Stanford-sized endowment and they have 2,000 kids there now, and it's very —the physical plant is very beautiful. It's like the Shire but for orphans.

Brady Huggett

Are they PA kids? They're Pennsylvania kids.

David Sussillo

Yes, it's a great question. The mandate, the charter actually, explicitly says this is really about Pennsylvania. The way that it works, it's a very multicultural institution, and oftentimes, there's a lot of kids from PA, and there's a lot of kids from the inner cities of Boston, New York, Philadelphia and D.C.

Brady Huggett

Got it. It's a mix. How did you get from Maryland to PA, though?

David Sussillo

My aunt and uncle — Oh, excuse me. No, they just said, "Hey, you're going to go to the school."

Brady Huggett

They looked around, and they identified it and said —

David Sussillo

They knew that it wasn't working out, so they're like, "Hey, this is going to happen. OK. This is going to happen."

Brady Huggett

Did you know it wasn't working out?

David Sussillo

It became clear. [chuckles] Yes.

Brady Huggett

Were you acting out again or were you —

David Sussillo

I just don't think it was working.

Brady Huggett

OK. It's not working. They were like, "We have to find some other place for you to go." Your sister, by the way, did not come with you.

David Sussillo

No, she did not. Another aunt and uncle of mine, they intervened for her, and they did not feel like they could actually take her into their house. Like myself, my sister also had behavioral issues. She ended up at a boarding school in the Berkshires and/or like New York state, right by the Berkshires or something right around there. We both ended up just on the East Coast in different schools.

Brady Huggett

How was the Hershey School for you? It's more resources, sounds like.

David Sussillo

Yes. MHS was OK. I didn't have a great time there, but it was not that almost Dickensian-like poverty that the ACCH was in the '80s. The ACCH is actually not the same organization these days. I went back there recently. It feels very different. When I was there, it was like-

Brady Huggett

Rough.

David Sussillo

-we were one step away from being on the street, and really, I was one step away from being on the street. That is not an exaggeration. Milton Hershey School, it's a much larger organization. You have, let's say when I was there, call it 1,000 kids. It's twice the size now.

Brady Huggett

Oh, wow.

David Sussillo

The kids are organized, instead of a cottage, they call it a group home. They're organized in group homes. Excuse me. I misspoke. They're organized in student homes of, again, the same ratio, two parents and maybe a kid of their own to 16 kids.

Now it's high school. I was bullied very severely at Milton Hershey School. I didn't really enjoy myself there. The education, actually, for me was not particularly exciting, so I tuned out for four years.

Brady Huggett

You did.

David Sussillo

Oh, yes, totally.

Brady Huggett

The bullying. You're a sizable human being. You're pretty big.

David Sussillo

I didn't start growing until I was almost out of high school.

Brady Huggett

Late bloomer.

David Sussillo

Yes.

Brady Huggett

It was a size thing or just because —

David Sussillo

Yes, it's a perfect storm. I was new and all those kids had been around each other. My house father was one of the most difficult house fathers at Milton Hershey School, and because of that was able to manage the most difficult boys at Milton Hershey School. I got really unlucky.

Brady Huggett

You were put in this house with all the other difficult kids.

David Sussillo

Yes, exactly. By relative standards, I was not very difficult. A lot of people have very different experiences at Milton Hershey School. I recently went back to, for the first time in 30 years, actually, I went back to a homecoming. Nobody denied my experience, but a lot of people said, "Hey, that wasn't my experience."

Brady Huggett

That they'd had a good time.

David Sussillo

Yes. That the school was meaningful for them, and that had got them out of trouble. Certainly, I have that perspective too, in the sense that, "Hey, Milton Hershey School was better than being on the street." There's no doubt about that. I'm not trying to disrespect the school. I just had a very, very unfortunate experience there. I got my ass kicked a lot.

Brady Huggett

I'd have to say that that's a long time, four years for that. That will affect your viewpoint on life. I don't know, I already find it remarkable that you found a life of intellectualism. It's very, I think you probably know this, it's very difficult for someone to come out of that situation and end up the way that you did. This is high school now. This is important for you getting into colleges and stuff, and you're tuned out. How are you getting the grades?

David Sussillo

I was smart.

Brady Huggett

You were just taking the test and doing —

David Sussillo

It was an easy school.

Brady Huggett

Wow.

David Sussillo

Yes. Aside from a home ec class in which I got to B, I would have been the valedictorian.

Brady Huggett

Really?

David Sussillo

Yes, I tied with a good friend of mine for second place. I don't know how to say it. I just didn't have to work at that school.

Brady Huggett

You didn't study. You'd go in, you take the test, you nail the tests.

David Sussillo

Yes. Don't get me wrong. Once we got to AP tests, and these are standardized tests across the country, I didn't do well in them. Of the five I took, I only succeeded in two, and that was primarily because those two teachers had expectations, and so you live up to those expectations. For me, though, a life of intellectualism, I guess, as you would say, that goes back earlier. For me, I was tested for the gifted and talented program when I was in, I believe third or fourth grade, and it became an out. I passed the test, so I made it into these classes. The classes were more interesting. I wasn't bored.

I think some of my behavioral problems, certainly not all of them, were related to boredom in school. I was in these different classes, and because of that, and probably the time — I was about 10 years old — I started to see that intelligence was a concept in the first place. Before that, I was completely oblivious. That concept had really far-reaching implications for not only the people around me in my interactions with them, but for my long-term future.

Brady Huggett

Yes. You understand that intelligence is a thing and it applies to you, that you have it-

David Sussillo

Yes, and that I have it. That's right.

Brady Huggett

-and this is an opportunity for you.

David Sussillo

Exactly. Yes. From the perspective of a kid making it out of one of these situations, I don't think it was central that it was intelligence. Intelligence has a lot of benefits, and not the least of which is you can understand what the hell is going on around you. If I had been, say, great at baseball, or if I had been, like, model beautiful, I think anything that gets you the attention of adults, because keep in mind, neglect is the thing that is the main problem we're contending with, that any of those highly valued qualities by society would get you the attention you need so that you understand what might be going on in your life and how you might angle yourself towards a successful future.

Brady Huggett

Like somebody singles you out-

David Sussillo

Yes, exactly.

Brady Huggett

-and says, "Hey, by the way, you're smart or you're good at baseball or you're supermodel pretty," as you said.

David Sussillo

You can see somebody. That's right.

Brady Huggett

That happened to you.

David Sussillo

Did it happen to me? I'm sure this will get clipped, but, this is emotional stuff for me.

Brady Huggett

Yes, of course.

David Sussillo

Yes, at school, the teachers definitely knew I was a smart kid, and it would come up. I don't remember a particular intervention, but I just remember always being the smart kid, and I began to focus on that. Then I had some conversation with another kid at the group home, this guy named Miguel, where we were talking about, "How the hell are we going to get out of here?" He was maybe three years older than me, more mature, but I was precocious. We'd have conversations about it and he's like, "Well, you could go to college, and there's a way to get money. I'm not quite sure how to do it." We were brainstorming together, and I'm like, "Well, Miguel, you can maybe work your way up a corporate ladder," and so on and so forth. Ultimately, that's what we did.

Brady Huggett

This was in Albuquerque.

David Sussillo

Yes. This Albuquerque. I was in fourth grade. I know it sounds preposterous. I had really planned my life out to at least college when I was 10. Like, "That's how I'm going to do this." Fast-forward to Milton Hershey School, which again, wasn't for me an intellectually enriched environment, I was just waiting it out.

Brady Huggett

You were waiting it out knowing that you're getting good enough grades so that you would have a chance to do something else.

David Sussillo

Yes, exactly. That's right. Through all of it, I was always sure to get good grades. It just happened that it was not difficult.

Brady Huggett

For you. You could not – again — not study, but get the grades, "OK, good, there's another A. Eventually, I'm going to find my way to college and that's my way out."

David Sussillo

Yes, exactly.

Brady Huggett

That's amazing. You, Miguel was also — When you're like, "How do we get out of here," you mean, "How do we get out of this group home?"

David Sussillo

Yes, in the long term, how do we survive this? Exactly.

Brady Huggett

OK. Then you finish your four years of high school. Did you start applying roundly for schools? How did you —

David Sussillo

Yes, I guess, because I was reading all the *Scientific American* magazines and *Discover* magazines when I lived with my aunt and uncle in eighth grade, I had gotten it into my head that MIT was the place where I wanted to be.

Brady Huggett

Not a bad choice.

David Sussillo

Yes. Because in these stories, they tell narratives in these more popular magazines, like, “Hey, this person did this crazy thing, and they worked this computer science or physics magic.” The next thing you know, there’s Jedi powers. I was totally enthralled by this. I really became focused on science at the Albuquerque Christian Children’s Home; Christian was no-nonsense. For me, if I had stayed in that environment, I know it sounds nuts to my ears today, I could have ended up as a preacher, totally.

Brady Huggett

Oh, really?

David Sussillo

100 percent.

Brady Huggett

You were getting a heavy dose of that.

David Sussillo

Oh, yes. Three times a week.

Brady Huggett

Oh, OK.

David Sussillo

One of the benefits of moving away from the ACCH was it gave me a little space from the religion, day-in and day-out religion.

Brady Huggett

You want to close them?

David Sussillo

Yes.

Brady Huggett

Let’s close them. Yes, sure. [silence]

David Sussillo

We’re right by a road, and ... OK, so let’s see, where were we?

Brady Huggett

You’re thinking about applying to schools.

David Sussillo

Yes, thank you. Yes. I think about applying to schools, and I may have aced the test at MHS, but I was not prepared for college. My test showed it. Like I said, I only got two of those five AP tests that I took. My SAT scores were OK; they were good, but they weren’t stellar. They were not the kind of scores that you need to get into a world-class technical institution. It’s really funny; you have to write this essay.

Brady Huggett

For college, right?

David Sussillo

For college, yes. I look back, and I just laugh. I had no idea what I was doing. I didn’t have any guidance. I get this thing, and I’m in AP bio class, and I pull out my handy-dandy ballpoint pen, and I just start going for it right there in the application about, like, swimming, which I couldn’t stand. I hated my swimming extracurricular activities.

Brady Huggett

You thought you were writing, “I’m a swimmer and this makes me suitable for college?”

David Sussillo

Yes, something like this. Just horrific, like full-on with crossed-out text and a carrot to say, “Well, this is really what I really —”

Brady Huggett

Oh my God.

David Sussillo

Yes, exactly. The letter came; it was very thin, and they said, “Thank you, but no thank you.”

Brady Huggett

That’s MIT.

David Sussillo

Yes, exactly, MIT. I had applied broadly, though, and I got accepted into a number of good schools, including Carnegie Mellon. That’s ultimately where I went.

Brady Huggett

Yes, great school. Great school for engineering, actually.

David Sussillo

Yes, totally.

Brady Huggett

That seems like a —

David Sussillo

It was a good outcome.

Brady Huggett

Great fit for you.

David Sussillo

It was a good outcome. Totally. It was a fabulous outcome.

Brady Huggett

This essay thing, if you’d written it today, of course, they’re like, tell me about things that you’ve overcome in your life or, and you had to overcome all these things in your life, and they were not in the essay.

David Sussillo

It was completely lost on me. Not even in my wildest dreams did I think that an essay that mentioned the challenges that I had as a kid might reflect well on me in an environment where there was a balance between challenge and support. No clue. Completely missing in my way of thinking.

Brady Huggett

Yes. It’s not even appropriate to share that with them, almost.

David Sussillo

Yes, exactly. Exactly. You could even go further, and you could say that, “Hey, maybe there’s some shame about these experiences, and so I don’t want to talk about them.”

Brady Huggett

Yes. Well, anyway, you got into Carnegie Mellon, which is a good school.

David Sussillo

[laughs] Yes, exactly.

Brady Huggett

What were you planning on studying there? Did you know going in?

David Sussillo

I wanted to study physics. Yes. I'd always been captivated by understanding the world, getting to the heart of the matter, excuse the pun. It I think really resonated with my religious sensibilities from my earlier years of just understanding the world and God and blah, blah, blah. So I got to Carnegie Mellon, and I started in physics, and all it took was one experimental physics class to convince me that that wasn't my path. Simultaneously —

Brady Huggett

What happened? What was it you didn't —

David Sussillo

Just because it's like, take a piece of yarn and tape it to a marble with duct tape, and now propagate errors for 20 pages. No, if that's what physics was, I wanted no part of that. In hindsight, I actually regret not sticking through because, well, it's all hindsight. Knowing what I know now, what I do now, physics and math and physics concepts are pretty useful in computational neuroscience, but I didn't know that then.

What I ended up doing, I ended up transferring to computer science, which is also really useful for neuroscience. I took the programming classes, the engineering classes, and a lot of actually really deep math classes. Now that's the kind of math that you don't use in neuroscience. It's all complexity theory and abstract algebra and group theory and things like this. It was a great education, but I don't really use that. What I use from computer science is-

Brady Huggett

Coding.

David Sussillo

-yes, just the ability to code. The computer has always been my friend. In fact, you could almost back out and say, "How did you make it?" You could point to the early computer. I had no opportunities, but I was in a public school, and by the early '80s, they were starting to bring the Apple 2e's in.

Brady Huggett

Oh, really?

David Sussillo

Oh, yes, totally.

Brady Huggett

Did that captivate you?

David Sussillo

Oh, yes. I remember "The Oregon Trail."

Brady Huggett

The game.

David Sussillo

Yes, the game. Exactly. "You died of dysentery."

[laughter]

David Sussillo

I remember Logo. Do you remember you used to draw with the little —

Brady Huggett

Yes, yes.

David Sussillo

I found these things captive- captivating. My teacher sent a note pinned to my shirt that said, “Please talk to David about the value of sharing. He refused to share his computer with his lab mate.”

Brady Huggett

Well, yes. You don’t have it at home.

David Sussillo

Yes, exactly.

Brady Huggett

Gaming has brought a lot of people into computers. That seems to be true for you.

David Sussillo

No. For me, if you go back to the whole beginning of it, it’s all about video games.

Brady Huggett

Like arcade games.

David Sussillo

Like arcade games. I’m 48 years old. I was 5 years old when “Pac-Man” came out. I was captivated by these games, and I didn’t have any money, but I would pretend I could play the games, and then I’d go scrounge up a quarter if I could, and I’d go play the games. Since I had no money, I worked at it, and I wanted to be good and make the experience last longer.

Brady Huggett

Make the quarter last longer. Yes.

David Sussillo

Yes, exactly. There’s some escapism there. There is a way of understanding a very confined world that you have a control over. There’s a sense of agency. I had no agency in life. I don’t think it’s particularly uncommon for little kids to be really interested in video games. I was one of those little kids.

Brady Huggett

So was I.

David Sussillo

I ran with it. My Xbox is over there. I still play. When I was a kid, it was really the thing that I was focused on. If you really wanted to go all the way back, that’s really the beginning of it.

Brady Huggett

When you’re at CMU and you’re learning to code, are you considering that you might want to build games?

David Sussillo

What did I think? At the time, no. It was a little heavier than that. I was focusing on understanding the world. I wanted to be a deep thinker, capital D, capital T. I was a little intense at the time. I was taking things very seriously. I went from, in high school, a pathological disinterest in all things academic to when I got to Carnegie Mellon, a pathological interest in all things academic. What had happened there was, I already told you, I spent the last 10 years planning this moment. This was like, “If I don’t pull myself up by my bootstraps right now, this will never happen. I will not make it in life.”

It became very, very serious. I was taking all the classes I could —the hardest classes I could take. I had a chip on my shoulder about not getting accepted into MIT. I really wanted to prove myself. All of a sudden, I’m super stressed out because I’m taking all these classes with kids who are way more prepared than I am. That was the mentality I had. It was really stressful because

when everyone is so much better prepared than you, you can't tell the difference between intelligence and better preparation when it's so far. You're like, "All these kids around me are geniuses. I have no idea."

Brady Huggett

They were just better prepared is what you're saying.

David Sussillo

They could have been smarter than me, but I know that they were better prepared.

Brady Huggett

Yes. If you had been able to prepare the way they had, you would have looked like that.

David Sussillo

I assume so in hindsight.

Brady Huggett

Yes. No, I would assume so too. Right. OK. Then after four years of CMU, upon graduation, did you — I know that you —

David Sussillo

[crosstalk] didn't graduate. Yes. I started working at a startup company in my junior year, and I needed money.

Brady Huggett

In Pittsburgh.

David Sussillo

In Pittsburgh. Yes, exactly. I was going to school part-time eventually, and working full-time. It was for one of the very first original, social-networking ideas, some idea that you pay money and it goes through a network and maybe somebody will answer your question. You submit a question and you pay money and maybe it'll go through and somebody will answer it and everyone on the chain gets a kickback. Interesting idea. No chance in hell that that's going to work. We know that now, again, in hindsight. Anyway, I helped build that whole system out and we built a team and I became a tech manager there. When that went belly up, I quit school.

Brady Huggett

How long did it take to go belly up?

David Sussillo

I guess I'm conflating two things. I got sick of being there because of just interpersonal interactions, so I quit. It went belly up another year or two later.

Brady Huggett

I see.

David Sussillo

Yes. I'm left with now, I'm at the end of my fourth year in college, despite being stressed out in my initial year, I ended up doing pretty well. I became friendly with a lot of people who also succeeded at Carnegie Mellon. I ended up taking a job in a startup company that was moving from Pittsburgh to Boston. That was a play of AI meets gaming. The play there was if you could build a better language for expressing the behaviors of AI characters, then maybe the AI and games wouldn't suck so badly. Another good idea, I don't think that's ultimately worked out. I ended up in Boston.

Brady Huggett

The company was started in Pittsburgh, but the venture capitalists want to move into Boston.

David Sussillo

No, it was started by a couple of professors in the CS department at Carnegie Mellon. I was just a peon programmer at the time, it's my understanding that they wanted to move to Boston to capitalize on the tech talent there.

Brady Huggett

That makes sense. You didn't finish your degree, and you went with them.

David Sussillo

Exactly. I go to Boston, and my life completely falls apart. This whole time I'm in college, they actually do a pretty good job. You go to college; you have orientation; you make friends; you're in classes. All that's gone. I have no friends, I've literally never lived alone. In fact, I've only lived with cozy groups of 16 kids. All of a sudden, I'm in a new city. I did not find Boston particularly welcoming, and my life fell apart.

Brady Huggett

You're living alone, working; you're going into an office at least?

David Sussillo

Yes, going into an office.

Brady Huggett

You'll interact with some people there.

David Sussillo

That's right. I had no girlfriend; I had no friends.

Brady Huggett

No social life at all.

David Sussillo

No social life whatsoever. I'm in this place, and within six months I go from being relatively, at Carnegie Mellon, on top of the world to I start having anxiety attacks. Legit, no BS, hide from the world.

Brady Huggett

Paralyzing.

David Sussillo

Yes, paralyzing anxiety attacks. When you have one of these types of attacks, it has the prominence of pain. It is the only thing that you're thinking about. You're just waiting for it to pass. I start going through this for six months, and I was not in a good place.

Brady Huggett

No, I wouldn't think — You're still employed there?

David Sussillo

Yes, I'm still employed there.

Brady Huggett

You're just muscling through this?

David Sussillo

Just muscling through it.

Brady Huggett

Oh my God.

David Sussillo

Yes, exactly. I might have a panic attack at the office, and then I'm freaking out. It's funny. The first panic attack I had was in the office, and I remember what happened. I'd never had one of these, not like that. I'd never had one like that. I'm like, "What's going on here? I don't feel quite right. Why can't I program? Why can't I focus?" All of a sudden I'm just bug-eyed,

hands on the table, staring around. Does anyone see what's going on with me? Am I dying? It passes, abridging six months of absolute misery. I finally reach out to an aunt and uncle of mine who live in New York.

Brady Huggett

Different aunt and uncle?

David Sussillo

Yes. They are both psychotherapists, and they'd been involved in my life. This particular narrative that you and I are having hasn't involved them, but they were around in a few very important points in my life. I felt comfortable enough reaching out to them, saying, "Hey, look man. I don't know what's going on here, but —"

Brady Huggett

This is what I'm feeling.

David Sussillo

I am not right. Ultimately, because of that, I got into psychotherapy.

Brady Huggett

They were able to identify it? They were like, "This sounds like a panic attack."

David Sussillo

Yes. They knew exactly.

Brady Huggett

Did they recommend somebody?

David Sussillo

Yes, they made a recommendation based on their own networks. Exactly. I moved to New York City to just be closer to them.

Brady Huggett

They were in New York? I was going to say, because the way to get rid of anxiety is not to move to New York.

David Sussillo

No, I was by them. It felt safer and closer than Boston. I did not have a good time in Boston. It took me a couple of years to get my head on straight, maybe a year and a half to two years. Then I started thinking about what's next. This crisis has passed. I joined a couple of startups. Finally, the dot-com bubble burst in I think it's 2001. I never finished my classes. I'm like, "I need to finish my classes because I want to go to grad school." I think I had four classes left. I go to Brooklyn College. I go to Columbia. I just find ways to get these four classes taken care of. Ultimately, I graduate in CS from Carnegie Mellon.

Brady Huggett

Wow. When you're having your panic attack, it's not easy to tell, I know, but the thoughts of your future, that's what was triggering you?

David Sussillo

Yes. What I would say is that I didn't know what to do with myself because I had this 10-year goal of surviving my childhood. It's true I quit school, which was a poor decision in hindsight. It was a poor decision even then, I'll be honest with you. I felt like I had succeeded at Carnegie Mellon. I was in the hardest classes doing not brilliant, but decent grades. I was working at a startup. I felt like I had been true to my own desires of what I wanted to get out of that experience. It wasn't so much that I quit that was causing me angst. It was thinking about the future. As you said, what next? I had nothing. I don't have any family support. It's really hard for people to understand. I don't call someone up on weekends, "Hey Mom. How are you doing?" Get that rush of warm love. Make me ready for the next week. I don't have that. That's not something that's part of my life. Because of that, I think we could go into some deep, dark places, but that's ultimately —

Brady Huggett

I'm sure that led to other feelings that were coming up. All right. You're like, "All right. I got to go get this degree finished so I can go to grad school." You do that. Did you know where you wanted to go or what you wanted to study?

David Sussillo

No and no. I went to Columbia University, for a master's degree. Of course, I have no money. It turns out a lot of academic organizations, Columbia, etc., they don't pay particularly well for administrative jobs, but they'll let you have a lot of a very cool fringe benefit, which is a free master's degree. I got a job there as the UNIX systems administrator of the electrical engineering department over, let's say 2001 through 2003. In the process, I'm getting a free master's degree in electrical engineering.

Brady Huggett

Do you have to apply to get into the program?

David Sussillo

Do you have to apply? I guess so. Yes, I must.

Brady Huggett

You must. They don't just give you —

David Sussillo

Yes, I must have.

Brady Huggett

You apply to get in the program, you get the job. The job is not going to pay you much, it's walking-around money, but the degree is paid for.

David Sussillo

Exactly. You can make it work. That's a good plan. During that time, I was thinking broadly about what I wanted to do. Now, of course, I'm in psychotherapy. I do at least have an hour with somebody every week to think about what's my life? How does my past inform my present? What do I want to do in the future? I started electrical engineering as a little bit of a catch-all discipline. The people at Columbia were pretty open-minded. They were cool with me taking a couple of exploratory classes in neuroscience.

Brady Huggett

Now this is beginning to coalesce a little bit.

David Sussillo

Yes, exactly. By the time I'm ready, I want to apply to get a Ph.D. I apply around for neuroscience because I think it's pretty cool. It sounds hokey, but I wanted to do something that my technical gifts could be applied to, something that may have something to do with the human condition. Yes, exactly. That's really why I got into it. No nonsense there. I applied broadly and was rejected everywhere, except for Boston University.

Brady Huggett

You weren't going back there.

David Sussillo

I wasn't going back to Boston. [laughs] That's right. I'm at Columbia, I have some visibility into what's going on because I'm in some of the classes. I see the weekend where all the prospective students come and go. I was not part of that. Somebody must have dropped out of the class at the last minute, because I got a call from the department head and said, "Hey, how'd you feel about joining Columbia University's neuroscience program Ph.D.?" Right at the last minute.

Brady Huggett

You had been turned down by them?

David Sussillo

No, I just know what was going on because I was there.

Brady Huggett

That's the program you got into?

David Sussillo

That's the program I got into.

Brady Huggett

You'd had this experience in industry. These startups. Were you not thinking about just being a professor in academic life, or you didn't know?

David Sussillo

I don't understand your question.

Brady Huggett

You had left CMU and worked at startups, right? That's out in the world. That's an industry job. Now you're getting the Ph.D. because you wanted to return to industry, or you thought you might be a professor?

David Sussillo

For me, it was never about a job. It's about the questions that occupy your mind. I find science exhilarating. To me, there's a stereotype. I know scientists know this isn't true. There's a stereotype that science is very technical, and it's very cross T's and dot I's. There are parts of that. I think of science as a deeply creative act. The more I was involved in research, the more I liked it, the more creative —It's basically just like any form of art. There is a structure around which you can be creative. For me, I don't mean to be hokey. The science was like reality. You can be creative about how you approach the problems. As soon as I got a whiff of it, I knew I wanted to be a researcher. It was never like "I want to be a professor," or "I want to be in industry." That wasn't my concern.

Brady Huggett

You just —I want to keep doing this. I want to keep asking questions.

David Sussillo

Exactly.

Brady Huggett

I think the creativity thing, your best scientists are creative.

David Sussillo

I agree. I think there's a lot of different ways to be successful. I think creativity is a big key.

Brady Huggett

You're in this program at Columbia, this Ph.D. program, four or five years?

David Sussillo

Yes, about so. There's this very now famous Columbia Neuro Theory Center. Larry Abbott and Ken Miller I believe, started it maybe with Stefano Fusi. I'm not sure if he was in on the ground floor. I started at Columbia before that was there. I actually started in an experimental lab, and it didn't work out. Actually, I went to Austria. I had a Fulbright grant my third year, and I got kicked out of the lab I was in at Columbia. I was just oil and water, me and this professor.

Brady Huggett

You didn't get along.

David Sussillo

Yes. I'm coming back now to my fourth year at Columbia. I tell you, there isn't a door I didn't come through to the back, I swear. I really mean it. I'm coming to my fourth year, I have nothing under my belt.

Brady Huggett

You mean you don't have a lab to come back to?

David Sussillo

No, I don't have a lab to come back to. The department chair at the time, I think he felt that I was hard done by the previous

professor. He's like, "Hey, Larry. You got this guy. He's got a technical background, he's done a lot of programming, he knows math, blah." Larry was like, "No, I'm not going to take this guy. He just got kicked out of a lab." I think there was a little back and forth, and ultimately he agreed to take me on rotation my fourth year. For those of you who don't know, that's not great. You should be well ensconced in a laboratory and on your way by that time. Thank you for that, department head of Columbia, and Larry, actually. As soon as I interacted with Larry, it's like, boom. This guy and me are on the same wavelength.

Brady Huggett

That's great.

David Sussillo

It took maybe six months to find a project that we both thought was interesting, and the next thing it's like almost telepathic levels of communication intellectually between the two of us. I had a Ph.D. into the details of it, but it was about training recurrent neural networks.

Brady Huggett

This is the — I'm not going to say famous, but the Sussillo and Abbott paper came out in 2009. That was a big deal.

David Sussillo

Yes, exactly.

Brady Huggett

That happened in your Ph.D.

David Sussillo

Yes, exactly. That paper was maybe a year and a half in the making. Really, once Larry and I got on the same playing field, then it was just amazing. I could transition into that but into the intellectual stuff.

Brady Huggett

Yes, just tell me what research went into that paper and then what it did for you because in my reading from the outside, that changed your trajectory a little bit. I don't know.

David Sussillo

Yes, a lot. Hugely so. The long and short of it is I was inspired by two scientists, Wolfgang Maass and Herbert Jaeger, liquid state machines and echo state networks. Before about 2012, looking past Schmidhuber, who did all this stuff in the late '90s, the general consensus was that you couldn't use back propagation to train artificial neural networks, and certainly not recurrent neural networks. There's proofs that you can't do it. Nobody was trying to do it. Instead, the people were exploring ideas that maybe just completely random interconnections between neurons would be enough of a computational basis upon which to build computations that are meaningful for organisms out in the world. That was the liquid state or echo state idea in a nutshell. At the time, Larry was working with Haim Sompolinsky and Kanaka Rajan on understanding random networks from a physics perspective, what phase transitions they have, are they chaotic, how many fixed points do they have, what dynamics do they have? What I think Larry and I identified together was that the training methodologies that were coming out of the echo state network world really might actually speak to some of the types of networks that they had been studying with hardcore statistical physics. I was the person that joined those two. What happened was I came up with a learning rule. It's basically glorified recursive least squares, but there's some details there that are pretty hairy. I came up with a learning rule, all of a sudden you can train recurrent networks on tasks that people care about.

Brady Huggett

Was this the FORCE learning?

David Sussillo

Yes, this is called FORCE learning. I'm going to abridge why it's FORCE learning. It solves some technical problems that are very real in recurrent neural networks. From the perspective of my career and the perspective of neuroscience, it's hard to underestimate what it means to be able to actually now train an artificial system to do something. I was in on the ground floor of that. Ultimately, the FORCE learning rule, it's used in other communities like in physics or in soft robotics or things like this, where you can't do back propagation, which is of course now the modern way of doing things in the deep learning era.

Because it was the first learning rule that you could really feasibly train a network, I was a kid in a candy store. Now I'm thinking, "Why do we join neuroscience? I want to understand how brains work. What does that mean to understand how brains work?" There's the biology of it, there's the computation of it, there's all kinds of things you could focus on. One thing is, how do all these neurons connect to give something that you'd call computation, which would ultimately give rise to behavior? Now for the first time, we can do it in these artificial networks. I knew right away that the real value of the FORCE learning rule wasn't the learning rule itself. It gives you the opportunity to understand how these networks work. Just to have it out there, the basic assumption is that artificial networks are useful to understand because it's a connectionism play. That is to say, any given unit in an artificial network is analogous to a biological neuron insofar as they themselves can't do very much with all respect to people who study single-neuron physiology. If you connect them together, then now you may be able to have a dynamical system of much more sophistication and greater computational complexity. I saw that opportunity and immediately went for it. What I did, now I'm a postdoc at Columbia. Go ahead.

Brady Huggett

No. I was going to say because I know you transitioned to postdoc there and then you did a senior postdoc out at Stanford, right?

David Sussillo

Yes, at Stanford.

Brady Huggett

OK, keep going.

David Sussillo

With Omri Barak, who is now at the Technion in Israel, we wanted to know how these things were working. I had been taking a nonlinear dynamical systems class, and what they do is there's fixed points where the system doesn't move around and you can linearize around these fixed points, and the linear systems is something we can potentially understand. All I did was make a culture play there, which was take literally textbook nonlinear dynamical systems material and introduce it to an entirely different field. With Omri's help, who really did the technical work of figuring out how to do the optimizations, we together cooked up a bunch of examples and together wrote a paper that showed that these networks that we're training really basic, think monkey, physiology tasks. Have a network do a go, no-go task with two bumps come in, it does this bump or this really basic network. Just think animal experimentation in terms of what they get these animals to do cognitively. We can now train these artificial systems to do artificial versions of it. Then Omri and I started applying our what we call now opening the black box, reverse engineering to understand how they're working. At least in simple cases, that textbook math and optimizations from the nonlinear systems theory worked perfectly. We knew exactly what was going on for literally the first time ever. I don't think anyone had ever taken a neural network of any sophistication, trained it with a rule that they didn't understand, and then reverse-engineered it. There's been a long history of building networks by hand, by construction to do a thing you wanted them to do, but then it's cooked in, what's going on because you put it in there, great. It's an existence proof of construction of how a thing might work. Because of that, we just thought, the world is going to be open to us in terms of understanding potentially how brains work.

Brady Huggett

Yes, I like how you keep saying that all you did was just this. I just added this to this and then we got —As if it was easy.

David Sussillo

In that case, it really was.

Brady Huggett

True, but still when a paper comes out and no one's seen it before, you know you've made quite a leap.

David Sussillo

True.

Brady Huggett

I was going to ask this about how you ended up going from the academic world to Google, but I think you've already answered

that question. You just want to answer interesting questions. As long as you have interesting questions in front of you, you're happy.

David Sussillo

Yes, exactly. There's a little bit more to it. There is the how to live a life side of it. I had a very successful postdoc with Krishna Shenoy.

Brady Huggett

He just passed, no?

David Sussillo

He just passed away. Sadly. We had this paper with Valerio Mante, Bill Newsome and Krishna about understanding how, potentially, again, with the same methodologies of using artificial networks as surrogates how understanding how primate brains may, for example, integrate information while ignoring —

Brady Huggett

Other stimuli.

David Sussillo

Yes. Other stimuli. We had a real feasible understanding of that. Whether or not it's true is anyone's guess, but we had a real hypothesis on data that was really as Bill Newsome used to say, that prefrontal cortex is the zoo. You had no idea what these single neurons are doing. Now all of a sudden we could piece that together, at least as a hypothesis. Because of that successful postdoc, I was very much considering becoming a professor, but then I took a look, and everyone makes different choices in life.

Especially coming with my group home background, the idea that I would have, back at a top school, work 60 hours in perpetuity until I retired, I don't know how to explain how allergic I am to that idea. [laughs] I just didn't want to do it. I think the fact that that's normalized in academia is pathological. Not everyone works that hard. At certain places they do, and so because of that, I started looking for other options. That's the, like, how to live a life portion of it.

Then the other was, you could spin that. I'm trying to understand how brains work by studying how neural networks work, or you could just say, Hey, figure out how neural networks work. Right at that time, Google Brain started, I think 2011. I joined a few years later. I was not quite ground floor there, but I was in pretty early. They were basically hiring everyone. Anyone who had any understanding of how to train neural networks, because at the beginning it was the Wild West.

Nobody knew anything, and because of the work of especially Geoff Hinton, but a lot of other contributors, people were starting to realize, wait a minute, these networks are really powerful. Google was all in on that. They took a risk on a neuroscientist, and namely me. That's another example of a back door that I got in. I did the interview and I had it completely mispegged. I'm giving this hardcore neurophysiology talk that would satisfy the likes of Bill Newsome to a bunch of CSS nerds who don't know the first thing about a brain.

They don't understand why I'm saying it or even what I'm saying. I get a call from the recruiter, thanks, but no thanks. Now I've already called up all my academic affiliations and said, "Hey, look, I know I was going to interview at your school. I just can't see my way to do that now, so I don't want to waste your time." I canceled all of my academic interviews, and now Google just told me go away. My next option is a social media site. I don't remember what it was called. It was like Hot or Not.

Brady Huggett

[laughs]

David Sussillo

I'm totally serious. All of a sudden I had —

Brady Huggett

I remember that site. I haven't heard that in so long. That's so funny.

David Sussillo

I don't think that was it, but it was something like that. All of a sudden my options have dwindled. I have three months of sleepless nights, and I get a call from the recruiter three months later, "We think we might have made a mistake. Can you come in and interview?" I interview with Geoff Hinton and Jeff Dean and I get hired.

Brady Huggett

Did they realize they wanted to do something that you had described in the phone?

David Sussillo

I think probably a couple of senior people went to bat for me. You have to understand the behavior of large organizations is highly multifaceted and multidimensional because you've got 50,000, 100,000 people there. There is no monolithic Google. There's small groups of people making decisions. It's entirely possible that because of lack of communication or culture mismatch, I just didn't come across as somebody they wanted to take a risk on. I think it's much more mundane than —

Brady Huggett

It wasn't like they suddenly realized the error of their ways or anything like that. Somebody probably just said, "We should take another look at him. We actually know what he's doing, or think it's a good idea."

David Sussillo

I'm sure somebody advocated for me. Otherwise, I would've never gotten that call. Whoever that was, thank you very much.

Brady Huggett

Three months after, again, you're like, "I don't know where I'm going to go next." Someone calls and says—

David Sussillo

Yes, exactly. I joined there and it was a great experience. I was at Google Brain for six years.

Brady Huggett

Six years or something,

David Sussillo

What was cool about that position is that it was at the very early days of deep learning. I was there 2000, I guess, 14 through 2020. It was one of those anything-goes types of experiences. What was cool about Google Brain in particular is their leadership I think really understood that neural networks were going to change the world. In particular, they were going to change their world first and quickly.

What they did is they embedded all of the applied teams to come work with the more academic researchers so that any advances on the fundamentals or foundations of training neural networks or any of that could be immediately applied to some of their core businesses. Nowadays, it's all public. Anything at Google that's too big. Many of the main core functionalities that Google provides when you go to their pages are all driven by neural networks. That was a direct result of the way that they oriented their team, which was really cool.

Brady Huggett

As you said, six years, and now you're at Meta.

David Sussillo

Yes, that's right. Now I'm at Meta Reality Labs. I work for the control group. This is, think Oculus, think video games, think virtual reality. I work on a team that focuses on electromyography at the wrist. This is so-called Control Group that was acquired out of New York City. I think this is all public information.

The idea is to really take consumer-grade technology and sensors and put them on the wrist so that you can read out the muscles there, of which we have many. Your hands and your arms and your wrist, and apply machine learning to it to decode those electrical signals, for example, for gameplay. You can imagine just point and now the system knows what you're doing and you don't have to hold a joystick. It's that kind of thing.

Brady Huggett

That'd be amazing. I want to ask a few things, and then we're done. I still sometimes feel, especially in academic corners, that there's a looking down upon of industry. Do you get that sense at all?

David Sussillo

Yes, I do. I have a lot to say here. Academia is a place where you can think about anything as long as you can get somebody to fund it. That's definitely a broader basket, a larger basket, than the kinds of things that are thought about in corporate research. I'm limiting myself in conversation to science and technology research as opposed to all of academia. What corporate research really excels at, and I think most academics are completely blind to it, is just the scope of what you can do in a corporate environment. In particular, we have money. We can hire, and we can hire lots of different roles.

You can hire research engineers, other scientists, managers, people who actually want to manage. There's this confound in academia where the professor also is a manager. Let me tell you, that isn't always great. I think we all know this. The other thing that happens in corporate research is if you want to be a type of scientist that doesn't become a manager, that's A-OK. Hey, don't make that transition.

You keep doing you, be the best you can be, and you'll have a promotion, you will continue to progress in your career, continue to make money, etc. Sorry, that doesn't really happen in academia. Unless you want to become a PI with all that that entails, you're just not going to survive in academia.

Brady Huggett

That's a good point. You can just be a straight — you can do all the hard science that you want in industry. You don't have to worry about elevating to take over the lab. You can just be a great scientist.

David Sussillo

That's right. In corporate research, the scope is more narrow. There are explicit goals to make money based off of translated research. That comes with the territory. The other thing that I would say is that corporate research tends to be much, much more collaborative than academic research. I don't want to cast too broad of stereotypes here, but in my experience, it's very true. I think that's because academia has a training mission, which is totally fine. In fact, it's better than fine. It's appropriate. People need to learn how to do a Ph.D. and part of doing a Ph.D. is walking in the woods for a few years and just meandering and figuring out instead of circles, the fastest way to get to A to B is to just walk straight if you can. That's a really important function. I do think that there is a downstream cultural effect where after that experience, there's this myth of the genius scientist kind of thing, where now I got to go to do everything myself.

I've got to reinvent every wheel, I've got to write every piece of code, solder every single circuit together. It is pathological to do this. It's especially true in neuroscience I think because we're all coming from different fields. To the degree that summarizing that academics scientists do have looked down at corporate research. I think it's misguided, it's unfounded.

Brady Huggett

Two things left, I think. One is, I saw this on Twitter. This is your Twitter account, or X, whatever. This was a while ago. This is when the Trump administration was separating children from their families at the border. You came out and said, "We have to stop this, and here's all the reasons why." It was based on your own background. I wondered why you had done that.

David Sussillo

I have never been particularly politically active.

Brady Huggett

That was my sense looking at your feed. Yes.

David Sussillo

I don't know how to explain it. I don't think I've ever come across something that our country did that I found so morally repugnant. Within a day of seeing that, I was at marches. This is wrong. I'm marching. As I'm going out to these events and this is happening on the news and it's happening in real life, I start realizing, like, actually my experience is not that. I'm not detained at a border, but I have something to say about what happens when kids are separated from their parents over long

periods of time, especially young kids. They were doing this to young kids. Because of that, I just pulled out a pen and started writing. And, I had, people reacted to that.

Brady Huggett

They definitely did.

David Sussillo

That was what would've happened there. It was a gut reaction. I just couldn't believe. I've never been in a position where I was like, "If not me, then who? I have to say something."

Brady Huggett

When I read it, I thought, "Oh." There's lots of reasons why people on Twitter are saying why they shouldn't be done. I'd never seen that reason before and I thought it was really astute. There's a final thing I want to ask about. This goes back to the thing you did, "Growing Up in Science." I watched some of that. You said a couple of things. You said one, as you start, you said, "I may get a little bit emotional as I talk about this, and usually it's the gratitude that gets me. That's what makes the emotions come up." Then you told a story about a boy named Shiloh, who you had known in the group home I think in Albuquerque. This story is almost literary in its circularity.

You were back in New Mexico, and you happened to just to see him on the street. At that point, your lives had completely diverged. Although you had struggled, you had gotten degrees, and you were well on your way, and he was begging for quarters. I thought to myself, and I want to ask because I don't actually know, but I think the reason that you get emotional over the gratitude is because your life was hard, but it could have been that.

David Sussillo

It could have been that.

Brady Huggett

If people didn't help.

David Sussillo

Yes, I would agree with that. For me, boy, there's a lot to say here. I am thankful for the things that I've been given, even though it hasn't been very much, especially early in my childhood. I was blessed with a genetic inheritance that has served me really well. When you don't have much, I think you value what you get. I think there's just some basic psychology there. I would say that with Shiloh, I actually found him online.

Brady Huggett

You did.

David Sussillo

Recently, a week ago. He's been in and out of prison for the last 20 years. There's a website that has just the pictures of this guy over the last 20 years from 2000. Each one is just a snapshot into —

Brady Huggett

He's posting them.

David Sussillo

I don't know where this is or how it had got on there. Just a snapshot of this person. He's almost surely mentally ill on the streets of a city somewhere, probably smoking meth. The other thing is Miguel, I just saw him. We had a little ACCH reunion. He's doing great. He's a preacher now. He made it.

Brady Huggett

He found the thing to pull him out.

David Sussillo

Yes. Exactly. I mentioned my sister; she passed away recently. She committed suicide.

Brady Huggett

I'm sorry.

David Sussillo

No, I think a lot of people have really different experiences in the background that I have. I would like to say that my place where I'm at in the world is a function of all the people who helped me. It surely is, but I think the answer is much, much, much more complicated than that. When I think about Logo, the little computer game drawing, somebody put that out there to teach kids. I think about whoever maybe invented the Z80 processor that was in all the games and it was in the TI-85 calculator, TI-81 calculator that I had in high school. The TRS-80 computer, which was my first experience with computers. What you can do in this world can have really long-term impacts in ways that you would never know.

Brady Huggett

Almost as if whoever created Logo didn't know that one day —

David Sussillo

Yes. They didn't know.

Brady Huggett

David Sussillo was going to see it and it was going to turn something on.

David Sussillo

Yes, exactly. Much more close to home, my aunts and uncles who intervened in my life and the house parents, even. I do think that as complicated as it is, if you put yourself out there and you make contributions, it's not easy to say who will do what or why, or how it all ends up, but you're adding a net positive to the world. That's how I would leave that.

Brady Huggett

One final thing, I know you're working on a memoir, do you want to talk about that?

David Sussillo

Yes, sure. I recently wrote and sold a memoir.

Brady Huggett

Amazing. You're not even working on it anymore. It's sold.

David Sussillo

Yes. It turns out you are still working on it. It's the editing; it's a nights and weekends project. I wrote down in much greater detail and with drama and scenes, the conversation that you and I just had.

Brady Huggett

Amazing. Any idea when it's coming out?

David Sussillo

Yes. It takes forever. It'll be out in two years. Summer of 2025. That's just how those things go.

Brady Huggett

That's it. Thank you.

David Sussillo

Great. Yes.

Brady Huggett

Thank you.

David Sussillo

Yes.

[transition music]

Brady Huggett

How was that? This one meant a lot to me personally, actually. It gave me a lot to think about. A huge thank you to David for an honest talk about some painful stuff. That kind of thing takes courage. Thank you very much. This podcast will be archived at thetransmitter.org. If you liked it, you can subscribe to “Synaptic,” wherever you find podcasts, whatever app or platform, Spotify, YouTube, Apple. You can also rate and review it, which helps other people find the show.

If you’re new to “Synaptic,” take a stroll through the archives. There’s a great interview with Evdokia Anagnostou in there, Ashura Buckley, as I mentioned, the award-winning episode with Ashura Buckley, that’s in the archives. Ardem Patapoutian, he’s in there, all free. Some of the information for our opening was taken from the ACCH website. Our theme song was written and performed by the great Chris Collingwood. That’s it. I’ll talk to you on Episode 9.

[ending theme music]

David Sussillo

Let’s see. What do we want to do here? This house is old enough that some of our stuff is a little funky. What happens if I unplug this?

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