Shrink Rap Radio #435, December 24, 2014, The Potential of Video Games to Fend Off Mental Decline

David Van Nuys, Ph.D., aka "Dr. Dave" interviews Clive Thompson

(transcribed from www.ShrinkRapRadio.com by Paula Bautista)

Introduction: On today's show, I'll be speaking with noted journalist and return guest Clive Thompson about his recent article, Can Video Games Fend Off Mental Decline?, which appeared in the October 23rd 2014 issue of The New York Times Magazine. Clive Thompson is a long-time contributing writer for The New York Times Magazine and a columnist for Wired. For more information about Clive Thompson, please see our show notes on ShrinkRapRadio.com. Now, here's the interview.

Dr. Dave: Clive Thompson, welcome back to Shrink Rap Radio.

Clive Thompson: Good to be here.

Dr. Dave: Well, I'm thrilled to have you on the show again. It's hard to believe it's been nearly a year our interview about your book, How Technology is Changing Our Minds for the Better. And I have to say, my brain is still buzzing from that interview, so once again, welcome back.

Thompson: I'm really glad you enjoyed it. I had a lot of fun, too.

Dr. Dave: Yes, I really did. I put you on my list of The Best of Shrink Rap Radio...

Thompson: (laughs)

Dr. Dave: ...and since this will be number 435, so that's saying something.

Thompson: Excellent.

Dr. Dave: So today we're going to be discussing an article that you wrote for the New York Times Magazine titled Can Video Games Fend Off Mental Decline? And needless to say, as a somewhat senior person myself...

Thompson: (laughs)

Dr. Dave: ...I have a real personal investment in this topic. You're a lot younger than I am, though, so I'm curious, what drew you to investigate this subject?

Thompson: Well, I had actually paid attention to this question I guess in the periphery of my attention for a long time. I'm a video game player from way back. I'm 45, so I am, really, the first generation of kids that played video games our whole lives. I was perhaps ten years old, or maybe nine years old, when Pong...

Dr. Dave: (laughs)

Thompson: ...first came across my ambient.

Dr. Dave: Yes.

Thompson: And then pretty soon I was playing Space Invaders and Pac-Man and The Big Explosion...so I was a late kid, an early preteen, when they came along. So what that meant is two things. One is that I really enjoyed playing video games; I have my whole life. The second thing is that I grew up with the concerns, sometimes expressed soberly and sometimes expressed hysterically... (laughs)

Dr. Dave: (laughs)

Thompson: ...that video games would irreparably deform my brain and my moral fiber in various ways, right? And it goes back as early as...you remember Ronald Reagan praising video games by saying that they would train the fighter pilots of the future. And this is, of course, a big issue back during the Cold War, right?

Dr. Dave: Yes. And now we have drone pilots.

Thompson: Drone pilots, exactly. Turns out he was so right in a crazy way that he could never have known, because it turns out that the skills for flying drones are really assisted by playing a lot of video games. So, I'd grown up with this concern and this issue, and I'd been spending all throughout the nineties and the aughts reading as much as I could on the way video games affect your perceptional apparatus, the way you think, your habits, and whatnot. And two things leaped out. One is that the earliest concern was really would they make us into violent little sociopaths, right?

Dr. Dave: (laughs) Yes.

Thompson: And that seems to have not really borne out. Outside of the fantastic data we have on the rapidly declining amount of youth violence – the exact people who are playing the video games – just whatever tests they'd been able to do as best they can, it seems to have a really narrow effect on aggressiveness or whatnot, except in a small minority of kids who already wrestle with aggression and impulse control. For them, it's actually...video games can be bad. For the vast majority of kids, not a problem at all.

So the violence thing has been...I wouldn't say it's settled. It's never really settled. But for now, that seems to be the answer. But what started happening – this is really interesting – once they got past the initial are-video-games-turning-us-violent concern, a lot of scientists started getting interested in "Well, okay, are there any potentially constructive or useful side effects of playing these games?" And a lot of these academics were people who themselves had actually grown up playing games, so they were in their late twenties and early thirties in the nineties and aughts when they started investigating this stuff. So this really got me interested. I thought, "what if there are any potentially positive effects?"

They started looking at things like the ability to train your attention, to move from stimulus to stimulus, which is something that adults tend to be...as we get older, we tend to get really bad at. It's called speed of processing, and it's our ability to go from focusing on one thing to focusing on another thing and going back and forth, and reacting quickly when someone says something or someone comes up to you and talks to you – absorbing it and internalizing, and then coming up with a response. This is all speed of processing.

It really gets worse in adults for a bunch of reasons. There are many things about the aging brain that get better, but this is the one that gets worse. And so they noticed that young people seem to get really sharp on their speed of processing the more they played video games. They actually got better at deploying their attention and ignoring irrelevant stimuli – that's another thing that the aging brain is bad at. We're bad not just at shifting our attention quickly, but we're bad at ignoring irrelevant stimuli. We get distracted more easily.

Dr. Dave: That resembles me. (laughs)

Thompson: Oh, my goodness, yes, I know, and I can already feel it myself, right?

So these game people were doing these tests on younger people and going, "Well, it seems like they get a little bit sharper on these skills that they're already sharp at." So they started wondering, "Well, maybe this is something

that would actually have a palliative effect in older people, too. If we had them play games, maybe they would improve in these eroding skills."

So this is how I got into this. The New York Times, actually, as it turns out, called me out of the blue. I'm a contributing writer for them and they were planning an issue devoted to aging – specifically, how to counteract aging. They called me and said, "Well, would you want to write a story about these brain-training games? Are they any good?" And I said, "Well, I'd love to look at that, because I've been studying it." And I'll tell you, though, it's kind of funny. It's a funny story. So when they first called me and said, "You want to write about brain-training games?" now that immediately brought to mind the panoply of things you see on the web or apps you see on phones saying, "This is based on brain science that will keep your brain sharp."

Dr. Dave: Right.

Thompson: And I'd known from having read neuroscientific op-ed articles and a little bit of research that there was a lot of very over-inflated claims made about these games. Most of the time they were made by, I don't know, someone just making a fun little memory Concentration game, and claiming that it had this scientific effect but having absolutely zero evidence. So my first response to my editor was, I said, "Well, (laughs) yeah, I'll be happy to write about this, but my sense is that most of the stuff on the market is snake oil." And I said, "So I'm not sure I'm going to find anything for you." But I wanted to keep an open mind, to see what was out there. As I said, I had looked into the periphery of my mind at this research, but I hadn't burrowed down deep and what. So I spent some weeks reading everything I could and talking to dozens of different scientists who'd done work on this, and the conclusion I came to is actually that the field indeed was of games specifically aimed at aging people. There are a lot of them out there. Most of them have not been tested in any way at all. But there are some glimmerings here and there that this stuff could be useful done in moderation and as part of an overall attempt to keep your body and your mind sharp.

Some of the most interesting studies had to do with looking at these very longitudinal effects, where they had had old folks play games and then follow them for ten years and discover, oh my goodness, there were some very small but very positive effects. In other cases there are some very, very robust and well-designed modern studies coming along, where they're saying, "Okay, let's not just guess at this stuff; let's do really, really carefully rigorously controlled science." And they're finding a couple of positive effects here and there. So I ended up in my story basically saying, "You know, this is still a very new field. It is still a very gestational field and it's mostly ignorant. We mostly don't know what's going on, and you have to approach almost all these games that are out

there on your phone or whatnot with caution, because there is very little research into them.

But it struck me that there was a maturing of the field. Scientists are trying to look at this more carefully. A few people who were designing the games were trying to design them more carefully. And there were also a couple companies that were trying to go for actual FDA approval for their games, which is really interesting, because then they actually have to prove that this device has some sort of an effect. So they're actually trying to say, "We're not just going to claim that this game improves the aging brain; we're going to prove it to the standard of evidence of the FDA, so that it can be prescribed as a medical device."

Dr. Dave: I would think that would be the holy grail for these companies, if they get that approval.

Thompson: Well, yes, because of course at that point in time, they can bill for it, right? A doctor could prescribe a game, and it would have a billing code, so an insurer could pay for it, right? At that point in time.

Dr. Dave: Yes.

Thompson: So there are obvious market reasons for companies to try to get serious about proving their claims, because if they really can do it, it could be enormously lucrative, right? It's a win-win. If they can make a game that really works and prove it really works, that's good for us, who are trying to keep our brains sharp, and good for them, because suddenly if Aetna or whatnot will actually pay for this thing, then the market grows by a lot. A lot bigger, basically. So it's basically...I concluded that it's very interesting times – still early times, but maturing, and people are trying to be a little more serious about looking at this area. It's very interesting.

Dr. Dave: Yes. Yes. You pointed out that it's already a 1.3-billion-a-year industry, and as you pointed out, a source of controversy. Now, in your article you talked about your visit to a San Fransisco lab where they're developing a game called Evo that some neuroscientists think might have positive potential. Maybe you could take us through that experience that you had when you visited that lab.

Thompson: Yes, sure. So basically this game is a really interesting one, because it was created by a scientist named Adam Gazzanica, and he runs...

Dr. Dave: What's it...I'm looking at your article. Was the name Gazzaley, by any chance?

Thompson: Oh, sorry! Gazzaley. My apologies, I'm completely mispronouncing it. Gazzaley. Adam Gazzaley. I apologize. G-A-Z-Z-A-L-E-Y.

Dr. Dave: Great.

Thompson: And so he runs a neuroscience lab in California. And his lab is really interesting, because...I mean, it's a traditional neuroscience lab, but he has a special competency in trying to think about this question of whether games could keep brains sharp, and so one of the reasons why his work has been received very well is that he has tried very hard both to run experiments that test for whether or not there is a measurable improvement in skill – so you have to test people's reactions and measure that stuff.

Secondarily, he wants to see whether or not you can observe, in brain function, when you peer into the brain with brain scanning, whether or not there are actual changes happening that are detectable at the brain-function level. Because then that gets more interesting, then you can say, "Well, not only are we seeing an apparent improvement, but we're seeing a brain change." Because there are a lot of reasons why someone's behavior could seem to get better without their brain actually improving. There are these things, well-known effects in science called the Hawthorne effect, where if you change the way someone does something and observe them, they sort of feel excited by participating in the experiment, and they get better, temporarily, at what they're doing because the whole situation is new and fresh. But after a while, when it stops being new and fresh, the improvement goes away. And this is a major problem for a lot of experiments. You give a bunch of kids iPads in their Grade 4 class, and lo and behold, the next six months they work harder, and they do a little better on tests and they write longer things. But that's because it's exciting and new to go to school – they've got these iPads. A year later, the iPads are no longer new, and their improvement sort of goes away.

So what he's trying to do is he's trying to not only see if he can spy an improvement in people's cognitive performance after they play this game, but he wants to see whether or not he can correlate it to actual changes you can observe in the brain. And this is, I think...he's being very meticulous about it, and this is why many neuroscientists are really skeptical about this field, where actually they all said to me, "Okay, if this works right, it's good. So what's it like walking into the lab?" Well, his lab is really funny, because in one sense it looks like a normal lab. You've got your couple of great big huge fMRI tubes for sticking your head in for scanning it...the MRI tubes. He's got a room filled with all the apparatus for EEG skullcaps, where you stick on your head and it records electrical activity. But he's also got the thing that looks basically like a great big awesome basement or man-cave where he's got an 80-inch massive TV for playing video games and a comfy chair, and a lovely carpeting. (laughs)

It really looks nicely designed. And it's because he really wants to study what happens to people's minds when they play games in the way that they would play them at home. Based on a nice big old...you know, sitting in your den with your big old flat screen. So it's a very fun place, and I got a chance to play this game, Project Evo, that he made, and it's an interesting game, because...so the way that his experiment was released a year ago, or reported a year ago, in Nature, what he did was he created a little game and he got a couple of former video-game makers to actually try and make it a good game so – because, frankly, a lot of scientists, they'll try and design a game, and it's just not fun to play. I mean, they don't know what they're doing. It is scientifically sound but it is not (laughs)...it's not very addictive.

Dr. Dave: Artistically, it falls short. (laughs)

Thompson: Precisely. Aesthetically and artistically and culturally. It hits the mark scientifically and falls short culturally.

He wanted a game where the people would be excited to play it, and they would not want him to take it away from them, like the excitement of playing a real game. So he got a couple of these guys in LucasArts, people who used to make games – Star Wars games, real, serious game makers. And what the game was designed to do...this original game he made called NeuroRacer, and we're talking five years ago. His theory was if you could get the mind doing a couple of different tasks at once, it would create a productive interference that would overall improve one's cognitive function. Because he was trying to avoid what's called the problem of transfer.

The problem of transfer is interesting. It means that you could do a game that would make you really good at one thing, but it would not transfer to other parts of your life and it would not transfer to other parts of your brain. So I could play a memory game on my phone – these typical "here's fifty cards, try and find pairs," classic Concentration game. If I played that for a few months, I would probably get really good at that game. But it would not necessarily mean – and we've found this in studies over and over again – it doesn't necessarily transfer to your everyday memory, right? I mean, I get good at that game but I only get better at playing that game. It doesn't help me remember where my keys went; it doesn't help me remember appointments; it doesn't help me remember facts that I read in the newspaper. And it also doesn't improve other aspects of my thinking, like, it's not going to improve that speed of processing, the ability to move back and forth.

What Gazzaley thought was "Well, if I can get people doing a game that requires two or three difficult mental activities at the same time, you will, overall, improve the brain." And so the way the game worked is you sit – and I

played his old game from five years ago, NeuroRacer – you sit down, you put on one of these skullcaps on your head, an EEG thing that measures the electrical activity. And you're driving a car and it's going down this winding path, and you're trying to simultaneously keep at a steady speed – you're not supposed to go too fast or too slow; you have to just stay in this range – and you're trying to not drive it off the road.

And...so you've got a bunch of spatial abilities being tested there, right? But at the same time, you're doing a very lightweight version of what's called a Stroop test. These are very classic mental-processing tests. You have to recognize when something is a certain color or a certain shape, and they'll try and fake you out. They'll say, "Hit the button when you see the red square." And they'll show you a red square, then they'll show you a black square, then they'll show you a red dot. And your brain goes "Oh, red! Red! Red! I better hit the button!" But it's not a red square; it's a red dot. They're trying to fake you out with color or they'll fake you out with a shape. They'll show you a blue square, and you're like, "Oh, it's a square! I should hit it!" No, it's not a red square.

So a Stroop test is a standard sort of test of your ability to pay attention to a couple things at once. You have to pay attention. "I'm not just looking for not just a square, but a red square." So you're sort of doing this little Stroop test as you're driving the car down the road.

Dr. Dave: Wow.

Thompson: And so there's a bunch of stuff going on. Like, I've been playing games for 45 years. It's a challenging thing to do. This game is also adapting to your performance. So if you're kind of bad at it, it slows the car down and makes the less winding path and gives you...it slows down the Stroop test. It's calibrating itself to you with the goal that as you get better, it gets better, too. And it calibrates itself, like, every three minutes, so...I played that, and it was difficult.

And what he did was he gave it to several dozen people in their sixties and seventies and had them play it for a month. And it was really interesting, because at the end of the month...okay, obviously they were better at playing the game, but again, that's the transfer question. Are you better at playing the game; are you better at life? Well, it turned out they were in fact better at a bunch of standardized tests for mental ability, and that was pretty cool. And they were also better at some tested abilities that had nothing to do with the actual game. So it seems, though, it had reached this fantastic transfer. Did it improve the basic spatial stuff – attention switching, but a bunch of other...like, working memory got a little better. And that's really interesting. Working

memory is your ability to hold a couple of tasks in mind at the same time, like I'm shopping and I've got a bunch of things in my memory. So it seemed like there was transfer, and that's really cool.

And the third thing – and this is really interesting – was that when he actually looked at the patterns of the brain activity of the older people...when you started off, the patterns of a 20-year-old and a 60-year-old looked really different. And he tested 20-year-olds and he tested 60-year-olds. But at the end of the month, the 60-year-olds, 70-year-olds, who had played this game had mental activity scanned out of their brains of these EEG caps that looked very similar to the 20-year-olds and no longer looked anything like the other 60- or 70-year-olds who had not played the game.

Dr. Dave: Wow.

Thompson: Yes. So not only could you see an improvement, an improvement in a wide array of skills, which is great, but the actual brain activity started to look a lot younger. He really dotted his *i*'s and crossed his *t*'s in the study. It's super interesting stuff.

Dr. Dave: What about subjective reports from the people?

Thompson: Oh yes, yes. That's a really good point. I asked him about that and he said, "Well, you know, many of them said that they felt a little sharper." But you always take subjective reports with a grain of salt, because again, you have the problem of that Hawthorne effect. The fact that they'd been playing a game...they know something's going on with their brain and so they're liable to just say, "Yes, I feel sharper."

And here's the other thing. And I'll give you the flip side of that too. I went up to the house of Ann, one of the women who was in his study. I guess she's in her sixties. And I asked her that. I said, "You know, you played this game for a month." She's like, "Yes." She had a lot of fun, she enjoyed, she got good at it, kind of cracked her up because she'd never played games before. Her grandchildren used to laugh at her not knowing video games. So she got good at the game, and I said, "Did you notice anything in your everyday life getting better?" And she sort of said, "Not really." Like she felt in an abstract way that maybe she was sharper and better at switching from task to task, but practically, how it improved her everyday life, not in any way she could detect. And to me, I found that really interesting, because it indicates that effects that you can test for, you can see an improvement in the lab, don't necessarily net out in everyday life. And so this is why I like to say...all the scientists who looked at this said, "This is interesting stuff," but, really, what we need to do is find some real-world stuff.

And there are hints of that in other research. There are definitely hints of potentially powerful real-world effects. But in this case, yes, there were some self-reports, but nothing you could really hang your hat on.

Dr. Dave: I seem to recall in your article...was she the one who had developed various tricks to help her remember things like taking her pills and…

Thompson: Oh, yes, yes, sure, sure. Yes.

Dr. Dave: ...and you noticed that there's a whole industry of external helpers... (laughs)

Thompson: Well here's the thing. Yes, see, as we get older, we get bad at remembering things. And one of the things that we particularly get bad at is what is known as prospective memory. You can loosely divide memory into a couple of different types of memory. There's autobiographical memory. That's my ability to remember things I did: I went to Paris in 2000. There is semantic memory. That's my ability to remember that Paris is a city…

Dr. Dave: (laughs)

Thompson: ...that the Eiffel Tower is a thing in – that sort of factual memory separate from my autobiographical memory. They're related, but…and then there's this third thing that is prospective memory, and that is my ability to remember to do something in the future. And it turns out that this is the one that really gets us in trouble, right? If you do studies and ask people "So, what type of memory failures really plague you?" they'll all complain about spacing out on a name or a phone number or a fact. And those are annoying, tip-of-the-tongue problems.

Dr. Dave: Yes.

Thompson: But the one that really causes damage to our everyday life and hurts our performance at work and everything is prospective memory: planning to do something and then spacing out on doing it. And so with old people, this is often a medical issue. You don't take the medicine at the right time, doesn't have the impact. And not just old people. You're in your twenties, and you've got an infection and you're supposed to take a regimen of three antibiotics every eight hours, and you don't do it and you remain sick for longer, right? So prospective memory failures are really a big deal.

The funny thing about old people is that they are really, really good at hacking interesting ways to externalize their prospective memory, so that their

environment does the remembering and the reminding for them. And people have noticed this for decades, that old people are really good at...as their prospective memory fades, they're really good at figuring out, "Okay, so what technique can I do to remind me?" And so that ranges from just leaving the pillbox in the center of the kitchen table. So every time you walk in the room, you see it, so you're going to be triggered many, many times a day to think about that. And then, of course, there's just this whole regiment of pillboxes with multiple, like 4 o'clock, 3 o'clock, 2 o'clock...and then putting post-it notes all over the place. I've read studies about these really amazing things, and there are a lot of technologies that are coming along, too, like they're making pillboxes that basically know how often you've opened them, and if you haven't opened them today, they start making a noise, and if you don't pay attention to the noise and don't open them, then they send a text message to you or to your loved one. I heard about these; I'm going to get one of these. I know the guy who created this company and met him ten years ago, and I followed his career – and it's really interesting – and this pillbox is really an interesting thing. They did a little corporate study of it, and it appears to have some effect.

So Ann, the woman who I visited who was in this study, in fact...one of the things that had alarmed her a little bit about her mental state – well, she said she had found herself forgetting things, like, she would forget her purse in the car. And she thought that was bad. So the game didn't necessarily improve her mind to the point where that problem went away, but she did find a classic sort of way to externalize and outsource the task into the environment, which is that she bought a much bigger, more colorful purse because as she pointed out, if you've got a little tiny purse it's easy to leave that anywhere, but if you've got a big one, it's harder to leave it behind. You know when you've got it in your arms and when you don't. And so this is a classic brilliant technique that aging people often hit upon.

Dr. Dave: Yeah. For me and my version of that is I buy covers for my iPhone and my iPad in outlandishly loud colors. So that… (laughs)

Thompson: Yes! Absolutely, yes.

Dr. Dave: ...I'm not going to forget them or leave them in a taxicab or something.

Thompson: Well, what I do for prospective memory, I'm a very heavy user of Google Calendar. I used to only like paper calendars. I hated digital calendars. So I only moved reluctantly, about five or six years ago, but here is what tipped me. It's because I can set up my Google Calendar to send me a bunch of alerts in advance of everything. So I've set it that 24 hours before, it emails me saying, "Hey, you're doing this tomorrow." And then it texts me one hour

before to say, "Hey, you're doing this in an hour," and then (laughs) it texts me 5 minutes before, "This is what you're doing in five minutes."

And I swear to God, this has saved my bacon. I work in Brooklyn. I occasionally...scientists and businesspersons and artists will come from Manhattan and I'll make a lunch date to go and talk to them in Manhattan. And it takes about an hour to get from where I am to get to the subway headed to Manhattan and be in Manhattan. So I can't tell you the amount of times where I have looked at my Calendar in the morning and "Oh, I have a 1-o'clock meeting," and then I space out on it. I forget about it. I get absorbed with my work, and then at noon, one hour before, I get a text message from Google Calendar saying, "Oh yeah, in 1 hour, you're having lunch." If that reminder did not come along, I would have just blown right past it and this poor person would...I would have completely annoyed them. So I do that. This works in concert, though, because I still find it possible to ignore those alerts. I still occasionally will not look at my Calendar, or will ignore something, and so the other thing I do is if there's something really urgent that I have to do before I leave the house or on the way out of the house, I get out a big thick sharpie and I just write in five words on a piece of 8 ½ by 11, duct-tape it to the front door…

Dr. Dave: (laughs)

Thompson: ...and my whole family, they like this. Now my kids are like**,** "Dad, remember to do this tomorrow," and I go, "I will," and they're going, "Put it on the door." Because they know that that...and it really works incredibly well. The other nice thing about that is that the whole family becomes aware of the memory issue, right? It's now a social piece of memory, because I'm saying, "Okay, buy the latest Percy Jackson book at Barnes and Noble today." Well, if I put that on the door for myself, the kids and my wife and everyone sees it and so that makes the memory a communal memory that we're all trying to remember to do.

And this turns out to also be an incredibly valuable mechanism, because Daniel Wegner, who's this wonderful researcher, psychologist, and he started noticing back in I guess the seventies and eighties...he wasn't even the first one to notice it, but he was the first one to name it. The fact that people who were in intimate relations – husbands, wives; friends; colleagues; children and their parents – people who are in intimate relations share the task of remembering things. I'm really good at remembering the details of when taxes and due and some financial stuff; my wife is really good at remembering stuff related to vacations, to school stuff. And so I know she's good at that stuff, and so I don't bother remembering anything. And so we are one joint brain remembering.

Dr. Dave: Yes.

Thompson: And so, a family works that way...and this is another really interesting clue to some of the problems we have with aging, which is that older couples, if they've been together for a long time, you and your spouse, you and your partner, have an extremely well-honed set of things you rely on each other for, in what's called transactive memory. And if someone dies, suddenly that chunk of memory leaves…

Dr. Dave: Wow. I never thought about that.

Thompson: ...and we knew – long before Daniel Wegner pointed this out – we knew that there was this feeling of being cognitively bereft that happens when a partner dies in your sixties or seventies – even in your thirties and forties, frankly, but more deaths happen obviously older...people would describe that it felt like a part of their brain was missing, and in a very real sense, it was. They realized that their ability to access parts of the past, parts of their daily routine, parts of plans and names, are gone because they were part of a system that was larger than their own mind. And that mind is now gone. And this is a really interesting problem. I often say...my mother – she's eighty now, so – she lives at home, but she's looked into potential homes to move into if she detects her memory problems becoming an issue.

Here's the funny thing, though, is that when you get older, often two things happen to you. One is that maybe you lose a partner, and the second thing is if you have enough memory issues, you move out of a home into a different residence. And those are both catastrophic for your everyday memory functioning, because when you lose a partner, suddenly half your transactive memory is gone, and when you leave your house, all the systems that you had set up to help externalize your memory are gone, too, because you're now in a new environment. And this is why you often see these catastrophic plummet downwards when someone is doubly bereaved and then moves out of their home. It's because our minds...and this is funny, this goes back to my book, actually, because in my book, it's how about technology affects the way we think and how often it's for the better. We like to think of our minds as being these...just floating in a jar and they're completely self-contained, but it's not really true. A huge amount of our thinking is very embedded in the people and the objects and the environment around us. And if you change those people, if you change that environment or change those objects, you can remove a lot of the scaffolds that allow us to think and remember in rich and deep ways.

So this story about...started off with video games wound up getting very deep into this question of the ways that not just the aging brains but all brains think and remember.

Dr. Dave: Yes. Yes. One interesting note is that as I was reading your story about Ann preparing for this interview, it reminded me to take my pills, my morning pills, that I've forgotten to take.

Thompson: (laughs) Yes. Yes. I'm in the middle of doing a regimen. I just developed two incredibly painful plantar warts on my feet.

Dr. Dave: Oh my god.

Thompson: And you would think, because they're painful, every time you step that you would remember to take the medication for it, but no, I space out on it. Twice a day, I'm supposed to do every twelve hours, and I blow past one. And there you go. So it is very interesting thinking about what systems could help us maintain better functioning. Of course, you see, by the way, the utility of transactive memory in this regard, because if your partner knows the medication has to be taken and is on top of it, they become an additional system helping you stay on track. If they are not there, if you are alone, or if they are incapacitated and they can't monitor that, everything gets a little trickier and you have to think of other coping devices.

Dr. Dave: Yes. Well, let's move on and talk about Lumosity, and also Posit Science and BrainHQ, both of which I have had experience with, and love to hear your stories around those.

Thompson: Sure. So, I guess if you were to think about brain-training games, the ones people know about, these are the two big ones in the field. There's Lumosity, and there's BrainHQ by Posit Science. And they both have different orientations related to the science. With Lumosity, you've got a company that was started about maybe six or seven years ago, maybe a little longer, by a young guy who was taking a neuroscience degree, neuropsychology, but got so interested in this idea of games as improving your thinking capability and your intelligence that he just stopped working on (laughs) this thing and started this company. He did hire a bunch of other people who think scientifically about this, and basically, they set about to try and create a bunch of games that in their view would improve your mental sharpness.

There's a Concentration game, like a memory game; there's speed of processing tests – you know, trying to react to something. There are games related to the Stroop test, those things where they'll show you a word, "blue" written in yellow, and say, "What color is…."

Dr. Dave: Yes.

Thompson: Yes, exactly. That type of thing. Now, there is not, by their own admission...now, Lumosity is interesting, because, on the one hand, when you talk to them, they're actually, I think, reasonably candid and humble about what's known and what isn't known about their games. They will tell you that there is not a huge about of science studying Lumosity. There's really only a handful of papers that have been published that have any sort of finding at all. And there's a file drawer problem here, which is that you hear about...somebody has a study that comes up with a positive finding, they'll publish it; somebody comes up with a study that's a negative finding, where there's no results, the games, they might not publish that, right? And so, you never know what stuff you're not seeing. So there's really only seven or eight papers that you could get your hands on that say there's anything happening with Lumosity. There are another several dozen in the works, but that's all there is right now. So when I'm in the room talking to them, they're actually quite candid about this. In their marketing materials, they are a little more assertive of the... (laughs)

Dr. Dave: (laughs) Yes, right.

Thompson: And so you have this schism where in the marketing side, it's basically, "It's all science, it's scientifically proven!" If you actually talk to them, they're like, "Well, there is some science, and it's provisional, and whatnot." So this is a classic marketing problem where – you find this in almost any pill company or whatever – where things get overblown when time comes to sell the things. So I think those games are fun to play. I've played them. Do they actually improve your thinking? No one knows, right?

Posit Science is a little different because it is actually founded by a very prominent neuroscientist, Michael Merzenich. He is a guy who back in the seventies and eighties was really one of the absolutely pioneering foundational thinkers about neuroplasticity, which is the idea that the aging brain changes and adapts all the time. It's not frozen solid. There used to be the idea that you grew up and your brain changed when you were young and then it sort of congealed like plaster and that was it for the rest of your life. And Merzenich was one of the pioneering people who said, "No, that's not true, and I'm going to prove it." And he did.

And he decided that because the brain could change all throughout its aging period, that he wanted to see if he could modify it and make it better. And so he started looking at games and he started developing games, and he acquired games that looked like they had some promise. One of the games that he incorporated into BrainHQ is one that actually does have some of the most solid science that's out there. Karlene Ball, a psychologist, created this very simple little rudimentary game in the nineties that tests what they call the useful

field of vision – I think I'm getting that right? Or useful field of view? It's either useful field of view or useful field of vision. And basically, think about it as your ability to look in front of you and how wide an area do you notice, right?

Dr. Dave: Yes.

Thompson: And what happens to older people is that that shrinks. They get more tunnel vision, basically. And this is a problem for a bunch of things. It makes it harder to drive. You're not noticing things in the periphery of your attention. Even makes it trickier, you're just walking down the street, you're paying attention to what's right in front of you but not seeing things coming at the sides. You get more collisions; you get more events where falling and collisions, all sorts of things come from. So if you could improve this field of view, that would be a really good thing. And so she created this little game that basically stresses and tests and encourages you to try and get a wider view. By the way, this is one of the things they discovered in young kids playing video games. That even just playing Call of Duty, where you're just running around and shooting stuff, it seems to improve their field of vision, their useful field of view, because they're having to monitor this environment, this very chaotic environment.

So Karlene Ball, back in the nineties, has this game, and it gets incorporated into one of the most genuinely longitudinal studies of cognitive training ever. And the Active Study, it's called. And what they did, it's quite astonishing. Along with Gazzaley's work, this is the other piece of research that even the very skeptical neuroscientists who think that this whole area is just overblown marketing hoopla – even they say yes, the Active Study is quite powerful.

So Karlene Ball had this little game, and it was used in the Active Study, so back in, like, '99, 2000, '98, this study took thousands of older folks and had them train, do three different types of cognitive training. One of them was given some basic memory techniques, like how to memorize lists of groceries by visualizing them, using these classic visualization techniques. Another one was given speed of processing stuff. Another one, they were given Karlene Ball's useful field of vision/field of view game to play. And they didn't play it a whole lot. We're talking about maybe a couple of dozen hours or ten hours over a short period of time, and then...or two and a half years, I think like a year and a half and four years later, a couple more hours to top off. So they didn't play this a whole lot. Yet, when they followed up with these people ten years later, they found that the people who had played the useful field of vision/field of view game were a little better at tests of that ability than people who hadn't played it. Everyone had gotten worse, because they were now ten years older;

they're in their seventies and eighties. But the people who had played that game had declined less than the other people. Noticeably less.

But this is the really interesting thing. Professor Ball went and got their driving records, with their permission. And it turned out the people that had played that game, even for this very small amount of time, had dramatically fewer incidences of accidents caused by them being at fault, right?

Dr. Dave: Wow.

Thompson: Fifty percent less accidents caused by them. And, of course, this is what you would predict if you thought people's field of vision remained superior, was that they would collide less. And this is such a real significant finding. It's not a little finding; it's a big one. And for that to happen with such a small amount, as another neuroscientist said to me, that's like doing a bunch of push-ups for half an hour in 1999 and finding it keeps you stronger ten years later. It's really interesting.

And it begs the question, as I talked to Dr. Ball and I talked to Michael Merzenich about this, because...property is now part of BrainHQ, what would the dosage be like to make it even better – like, how much should you play this certain amount everyday? So Merzenich has done probably more than any other company out there. More scientists have used the BrainHQ Posit Science studies...software than pretty much anyone else. Like, on his website, he lists over 70 papers that have used it. That's a bit of an exaggeration. It refers frequently to the same data set, like the Active Study is referred to many, many, many times. It's not quite 70, but it's definitely more than Lumosity, or more than anyone else. So there's definitely more science to be had with BrainHQ. It's still not terribly rock-solid. I mean, as much as I think Merzenich is a terrific scientist, the company itself over-blows on the marketing side its own findings a little bit too much. This stuff is still not anywhere as well understood as one would imagine. But there's not nothing there. There's not nothing. There's some sort of a signal to be pursued and looked at here.

Dr. Dave: Boy, several things are on my mind right now. One is with all the games that you've played and games like Call of Duty and so on, I would think that inadvertently, they have many of these same elements, and so…

Thompson: Oh, yes. Yes. Yes.

Dr. Dave: ...and so it'd be interesting to see at some point – I don't know if anybody's done this research yet, but to look at people like you who've been playing games all their lives, and to see...does that slow down the cognitive loss or not?

Thompson: Yes. Yes. Yes, exactly. There's been a couple good meta-studies that tried to look at everything we could find about games and cognition, and some of them actually looked at studies that were just of...exactly what you're talking about, a regular game, not one that was designed for scientific purpose. And they have found small effects here and there. They often related to things like this question of speed of processing and the field of vision. It seems like yeah, my having played...I went out and bought Dragon Age the other day, which is a new game I'm playing on my PS3, and I haven't cracked it open yet but it's your classic running around, engaging in knight-errant battles and magic and stuff like that. And I can tell you, when you're in the middle of one of these games, there are downsides... (laughs)

Dr. Dave: (laughs)

Thompson: ...to playing video games. They're very addictive, man; you can blow off your work and wind up homeless wearing your underwear in your parents' basement.

Dr. Dave: (laughs)

Thompson: I'm the first one to admit that I've struggled with how fun they are. But definitely, when you're in the middle of it, they're cognitively demanding environments. Like, a lot of these games now, you have to remember an overall task. "I'm trying to defeat this...I'm trying to get to the end of this quest," and there are all these sub-things you have to remember, like "I'm trying to manage my abilities. If I'm going to fight this particular monster, what type of ability should I deploy? I've got plenty of different abilities." So there's all this mental stuff on top of...if you were to look at the screen you see someone hacking away at a dragon, but there are all these other mental tasks going on and I'm trying to balance, and often I'm having to monitor a very complicated informational environment. Because a lot of these games now – in the old days, you played Space Invaders, all you had to look at was a bunch of missiles coming at you – now there'll be what they call the heads-up display that shows me..."What's my power meter? What's my enemy's power meter? What is my magic power meter? Do I have enough magic stored up to be able to deliver a knock-out blow? Oh, there's the map; where am I oriented in the battlefield?" It's an astonishingly information-rich environment that is, when you're in the middle of it, it's fun, it's delightful, it's got that sense that Mihaly Csikszentmihalyi talks about flow, where even though it's hard, it's joyful, because you're pushing yourself to the limits of your abilities.

So having experienced that, and enjoying it so much that I go back to it voluntarily, I certainly find it plausible that there is something useful to be had

about this. I think that the question with keeping your brain sharp in games is this question of "what are you doing with the rest of your life?" I mean, all the neuroscientists...there was a very strong statement against brain-training games and brain-training games' hype that came out recently from the Stanford Center on Longevity. I talked to their head scientist there and she said, "The problem is that we can't tell people that only playing a game is going to be sufficient for keeping their brain sharp if they, for example, have a terrible diet, if for example they don't get any exercise, if they have no social contact, if they don't do any reading, and if they don't do any skill acquisition. One of the things that appears to work really nicely for keeping your brain nimble as you get older is constantly acquiring and deploying new skills, like I'm going to learn how to do a new language; I'm going to learn how to do this particular art form; I'm going to learn this thing. There's something about that that really seems to have a salutary effect on your mental function. So even though the games might be incredibly delightful, you have to do it as part of an overall program for keeping your body and your social life sharp, because as we have now learned, these are all embedded in one another.

Dr. Dave: Yes, and now speaking of the body, going back to Gazzaley, you mentioned in passing that he was working on a body–brain trainer.

Thompson: Yes! Body Brain Trainer.

Dr. Dave: What's the status? Yes, what's the status of that?

Thompson: Very cool game. I got a chance to look at it. So basically, the way it works is it's a game that runs on the TV, so I walk in a room and there's this 70-inch, 80-inch TV, and it's hooked up to an Xbox. Now, an Xbox has this controller that's called the Kinect controller, and really what it is it's just a camera that looks out at your body, scans how you're holding your body and uses that to control things on the screen. So you could use it to virtually bowl or...if you jump around, the character on the screen jumps around. So he created a game that basically...it does that same thing where it gives you a couple of tasks to do simultaneously that are hard. So you are on the screen; you see someone riding a horse away from you. You are the person on the horse. You're controlling the horse. And as it rides along, it has to jump over objects and lunge out of the way of obstacles. And so you're having to move your body around and do these big jumping maneuvers whenever you see an obstacle to make a jump.

Dr. Dave: (laughs) Yes.

Thompson: But at the same time, there are one of these classic Stroop tests happening up top where you have to lunge over to one side or up or down when

you see a target object – and I think it was something very funny. One was like a radish, and there was a carrot; you get the radish and not the carrot. Things that look similar but are a little different. So a classic test.

So you're simultaneously paying attention to the horse and trying to control the horse or jump over obstacles, but you're also trying to do this thing, and if you want to get the radish off left, you have to lunge out far to the left. So I watched a young (probably in her late twenties) woman play this game – and you're wearing a heart monitor too, so it actually monitors your heart rate – and after barely a minute or two of this she was like, 140, you know, heart rate. And all this mental stuff going on...and what Gazzaley wants to test is whether or not there is an additional benefit to your brain to doing this very embodied form of cognition, to doing a thinking task that requires you to react to stimuli with your body as well as your mind. And as he pointed out, this is something that really only high-end athletes have to think about, where they're having to use their body in a very precise way to react to patterns and whatnot, and his hypothesis that this could be good, but it will take him a few years to test it. It looked like a gas, I mean, the game is...

Dr. Dave: Yes, it sounds fun.

Thompson: And the funny thing is, of course, this is again related to things that are out there on the market, because, beginning, I guess almost ten years ago, there was the Dance Dance Revolution phenomenon, where you could buy this 3x3 grid of pads that would sit on your living-room floor, and you had to dance on the pad, putting your foot down on different pads in a dance pattern in sync with the music and a grid that's on the screen. And I've played this game. (laughs) It's really hard.

Dr. Dave: (laughs)

Thompson: And you would be just exhausted at the end of it, and there were all these people who did Dance Dance Revolution diets, where they would play it for two hours a day and they lost, like, thirty pounds.

Dr. Dave: Wow.

Thompson: Crucially, not limiting their calories, just burning more calories, because, of course, exercise is boring and dull, but this is fun and it's a game, and so once again, we can use these things. This is what Jane McGonigal, the game theorist, calls positive psychology. The one thing that's really useful about video games is that they work on positive psychology rather than trying to say, "Don't do this because it's bad for you." It encourages us to do something that's good for us by making it fun. And this is the promise of games

that could actually get us to using our bodies like that, is that they could harness the positive psychology of game design to say, "Yeah, don't just dance around for ten minutes; do it for two hours," and really get your heart rate up there. It's just funny. It's just making me think that I need to go out and get one of the Dance Dance Revolution pads for my family, because I'll bet my kids would find this hilarious, and I am too sedentary. I mean, I am a journalist. I sit in a desk all day long. I need to move my body.

Dr. Dave: Yes. Wait, which platform is that on, by the way? (laughs)

Thompson: Oh, you could get it for anything. You could get Dance Dance Revolution for a Nintendo system, for a Sony Playstation system, for an Xbox system. It's an old-enough game that you can get it pretty much anywhere. In fact, you could probably buy about a 7- or 8-year-old Playstation that's 30 dollars now, the Playstation 1, and find an old version of it for 3 dollars and the pads for 15 bucks on Craigslist and have the whole thing set up. It's one of the nice things about it, doesn't require a high-end expensive system. You could get it to work on anything. Those are fun games.

Dr. Dave: Something that you touched on that we should mention is the cognitive fatigue that can set in and create some resistance to staying with these games that are quote, "good for us."

Thompson: That's right. That's right. Yes. Yes, there's a couple dangers with games, where I guess limits of games as a palliative is that on the one hand, they can be very addictive and they can be a lot of fun. But there's also a thing that everyone who actually plays games, and I've certainly noticed it, will tell you is that there's a curve of interest. You get very gripped by something, but then after you've played it for a little while, you feel like you've sampled all there is to experience with it, and you drift away. And in one sense, for regular video games, this is good, because it prevents you from constantly (laughs) playing the game and never doing anything else. There's this moment when finally you're like, "You know what? I think I'm done. I've actually played this game enough. I understand all of its complicated aspects; I understand all of its dimensions; I don't need to play it anymore."

And for people like me, who can be a little compulsive about games, that's a delightful moment. It's the moment when the game releases you from its talons and you can go wash the dishes and pay attention to your children. But this, of course, is a problem for creating a game that is going to be good for us, that we should play regularly, is that the typical way that I or any other gamer play a game is that you find something fun, you get very addicted to it, you go kind of crazy, and you drift away, for reasons that are organic or whatnot. That's not how you want people to do something healthy for them. You want them to do a

little bit everyday. You don't want them ever to get so addicted that they're doing it to the exclusion of other things. You want them to do it ten or fifteen minutes a day, twenty minutes a day, and to do it for fifteen years, and no one's designed a game that's like that. Most people made games that are designed to get you very addicted, and then keep you in for as long as they can, but knowing you'll eventually stop doing it, right?

Dr. Dave: Yes. I was going to ask you, in fact, with your exposure to these brain-training games, are you currently continuing with any of those? Or are you…

Thompson: No, no, I'm not. I'd tried BrainHQ and I'd tried Lumosity, and I found them kind of engaging. Definitely they're well-made. But yes, at some point in time, I just drifted away. That's the problem.

Dr. Dave: Yes, one of the things that happened for me was Lumosity – and I'm not sure if this is true of BrainHQ as well – was you always have to start back at the beginning. I wanted to have some sense of progressing and it gets a little boring to always start from zero and work your way up.

Thompson: Yes, absolutely. It feels like they need some way of designing something so that there is a little bit of novelty along the way that makes it feel like we're exploring new ground.

Dr. Dave: Yes.

Thompson: That strikes me as an important design element. So yes, I think you've hit on something that is puzzling to the people who make these games...and I'll tell you, there are people inside the world of games...they don't make games for serious purposes; they don't make games for medical purposes; they just make video games. And they'll say, "Man, give up on the idea of making a game that has any secondary purpose, because it's so hard for us." They'll tell you, "All we're trying to do is make games people will get addicted to and pay money and play obsessively for one month before casting it aside. And we have trouble even doing that." Right? Making a game *qua* game, making a game in and of itself, is so extraordinarily aesthetically and technically and culturally difficult that making it also serve another master, which is to say, a healthy purpose, a salutary purpose, is really (laughs)...you're jumping over two very, very high hurdles. Or I suppose you're taking a high hurdle and making it even higher, if that metaphor makes sense.

Dr. Dave: Yes. I wonder if you saw that, coincidentally, there's an article in last week's New Yorker magazine about the X Games and how these video games are now being taken seriously and there are major tournaments, and they write about a young woman by the name of Scarlett who's made hundreds of

thousands of dollars and has had to go to South Korea where the really champion (laughs) gamers are. Have you seen that article?

Thompson: Yes. I've seen it. I have not read it…

Dr. Dave: Oh, you definitely want to read it.

Thompson: It's sitting in my New Yorker pile, and I've been following this rise of professional gaming, sports gaming, and basic games as spectacles that we watch even if we're not playing them ourselves, we find them interesting to watch. And yes, exactly, at their best, really good games are not only engaging play but they are so strategically interesting that it is fun to watch a master do it in the same way that it's fun to play basketball and it's really fun to watch people who are absolutely fantastic at it play. And I've definitely experienced this. This is one of the things I think that was ill-understood in the early days of games, the eighties and nineties. There was this idea that they would isolate you, because you were staring at the screen all the time. But the truth is the games were and have always been extremely social. You would go over to your friend's house, and you would watch them play, and you would talk about their play, and you would hand the controller back and forth even to argue about strategy, and even now I see, with my kids, who are seven and nine and their friends are that – they all play Minecraft, and sometimes they'll invite a friend over. They'll go over to a friend's house when someone's playing a game, and they'll just sit there chattering and talking about it for an hour and a half.

Dr. Dave: (laughs)

Thompson: Someone will be doing something but they're just trading this blizzard of information and knowledge and thought about the way the game works. So a really good game inspires as much cultural conversation as a good sport or a TV show or a book does. And that I think is what you're seeing when you look at the rise of these professional game players, is that it's a very interesting maturation of the field. It's halfway between watching Kasparov take on another grandmaster in chess, and halfway between that and going and watching a baseball game or something like that. It's very interesting.

Dr. Dave: Yes. Well, I have a hunch that we're running up against your timeline. I know you've got lots of things on your taped list on your door, probably. (laughs)

Thompson: (laughs) Yes.

Dr. Dave: So it's always such a blast talking to you, and so I really want to thank you for being my guest again today on Shrink Rap Radio.

Thompson: Well, thanks very much. I enjoyed it too.