

Shrink Rap Radio #188, December 27, 2008, Technology and the Evolving Brain, with Gary Small, M.D.
(transcribed from www.ShrinkRapRadio.com by James W. Henry, III)

Excerpt: *We know that surgeons who play video games make fewer errors in the operating room. So, hand-eye coordination is improved. Peripheral vision can be improved. There's a computer program that's being distributed to older drivers in Pennsylvania, hoping that it'll help their driving skills, improve their peripheral vision. The downside is there in many ways. There's technology addiction. There are studies showing an association between too much technology and worse symptoms of ADHD. There's even controversial studies suggesting it could contribute to autism in young people. So I think there's...we know the brain is complex, we know the technology's complex. And what we need to do is recognize the relationship and try to harness the power of the technology so it improves our brains and improves our lives.*

Introduction: That was the voice of my guest, Gary Small, M.D., who along with his wife is coauthor of the 2008 book iBrain: Surviving the Technological Alteration of the Modern Mind. In addition, Dr. Small is a professor of psychiatry at the UCLA Semel Institute and directs the Memory and Aging Research Center and the UCLA Center On Aging. He's one of the world's leading experts on brain science, and has published numerous books and articles. *Scientific American* magazine named him one of the world's top innovators in science and technology, and he frequently appears on *The Today Show*, *Good Morning America*, *20-20* and *CNN*. Dr. Small has invented the first brain scan that allows doctors to see the physical evidence of brain aging and Alzheimer's disease in living people. Among his numerous breakthrough research studies, he now leads a team of neuroscientists who are demonstrating that exposure to computer technology causes rapid and profound changes in brain neurocircuitry. Now, here's the interview.

Dr. Dave: Dr. Gary Small, welcome to Shrink Rap Radio.

Dr. Gary Small: Well thank you, I'm delighted to be here.

Dr. Dave: The title of your latest book is iBrain, which as someone who has an iMac, and iPod and an iPhone, is sure to get my attention. Also, after I got your book, I remembered that you were mentioned several times in the book I Can't Remember What I Forgot by Sue Halpern.

Dr. Gary Small: Laughs

Dr. Dave: ...who I also interviewed some time back and I was so proud of myself for remembering your name amongst all the other names that she mentioned throughout the book.

Dr. Gary Small: Well that's great that your memory is still intact so you could...not forget that mention.

Dr. Dave: It surprised me because memory has really been a struggle for me and...that may crop up again in this conversation.

Dr. Gary Small: Well I think that memory is a struggle for so many of us and I've been studying the brain as it ages for as long as I can remember and...it's really the concern of so many baby boomers and middle-agers and seniors because they notice a change in memory as they age.

Dr. Dave: Yes, boy, I certainly am noticing it myself. Then I also encountered your name more recently when a friend directed me to an article in the New York Times describing some of the recent work in your lab. It was November 30th article, of this year about your research, suggesting that the brains of older adults may benefit from web-surfing.

Dr. Gary Small: Well this study stemmed from the research I was doing for the new book you mentioned iBrain

Dr. Dave: Yeah

Dr. Gary Small: And in trying to understand the work that had been done already, I saw there was a knowledge gap. And the book, which looks at not just how we measure the brain's function with technology, but how today's new technology impacts the brain. It was remarkable to me that no one had studied what our brains look like when they're searching online, which is a very common computer task these days. And that's...when we did that study, it really made the headlines internationally.

Dr. Dave: Yeah, yeah and I want to talk about that some more, but before we do, just give us a bit about your background.

Dr. Gary Small: I'm a geriatric psychiatrist, and I studied as an undergraduate at UCLA, and I was urged to go east to medical school, so I went to USC in East L.A...

Dr. Dave: Laughs

Dr. Gary Small: ...and then I was told, no go farther east, so I ended up at Mass General, doing a General Psychiatry residency. I came back to UCLA, studied geriatric psychiatry, and was fascinated by Alzheimer's Disease and brain imaging from the beginning, and have...worked on that for many years, and felt that the key was to try to protect a healthy brain rather than try to repair one once it's damaged. So we've developed imaging...brain imaging technologies to detect the first subtle evidence of Alzheimer's years before people have obvious symptoms. And we've looked at genetic risk factors, that will help us with that, and we've tested medicines and lifestyle approaches to try to protect the healthy brain before it declines. We try to stave off brain aging and Alzheimer's disease.

Dr. Dave: Wow...well, before we get into the details of your book, maybe you can tell us something about research that is currently underway in your lab.

Dr. Gary Small: Well, we have grants from the federal government, and from foundations and private donors, to refine some of these neuroimaging tools. We've invented a new brain scan chemical marker that we use with PET imaging. And we're able to see the physical evidence of Alzheimer's disease, the amyloid plaques and tangles for the first time in living people. And so we're studying people with mild memory complaints, people with different forms of dementia, like Alzheimer's and frontal temporal dementia. And we're comparing this kind of scanning tool with other scanning tools. We're studying genetic risk. We're refining a test we use called the...well I call it the 'brain stress-test,' and we use Functional MRI to look at how the brain is functioning from moment to moment, while we present people with a memory test. It's analogous to a cardiac treadmill stress test, and gives us quite interesting results. We also are quite interested in looking at supplements, and one that our basic science group has been looking at is curcumin and turmeric, which is in curry spice. We know that in India there is a lower rate of Alzheimer's disease, they eat a lot of curry there and this curcumin is a potent anti-oxidant and anti-inflammatory and also may disrupt the amyloid plaque aggregation. So, we have a lot of innovative studies like that. We have a 'brain boot camp' that we've developed, where we teach people memory techniques and healthy brain lifestyles. And we have memory training classes actually available throughout the U.S. So, we'd like to be at the cutting edge of innovative science, and we'd like to translate that science into programs that we can make available now to the public.

Dr. Dave: That's terrific; in fact that was one of the things that I wanted to ask you about, was, you know we hear about, that we should exercise our memory just in the same way that we would exercise our muscles to say healthy. So I've just wondered how much of that is hype, claims for 'mental gyms' that will stave off Alzheimer's, or normal forgetting associated with age.

Dr. Gary Small: Well let me also disclose that I've helped several companies with brain training electronic devices—Radica Games, Mattel, where we developed a little hand-held toy that gives you brain teasers and memory techniques. And a more sophisticated tool for a company called Dakim, called the Brain Fitness System. So in addition to the memory classes that we developed at UCLA and these more commercial types of approaches, we've got to think about these kinds of techniques in two ways. First, you mentioned the possible 'hype,' and I think there has been some hype with these devices and programs, because the studies have shown—they're reported as 'mental activity lowering the risks for Alzheimer's.' And that's how it's reported with epidemiological studies, that if people do crossword puzzles, or read or go to college they have a lower risk for getting Alzheimer's disease. But it's not really proof of cause and effect. It's possible that people who go to college have, you know, terrific brain genes, and that gets them on the college trajectory. And I suspect that it's a combination of nature and nurture. So, we haven't yet proven that keeping the mind active will protect brain health. Despite that, many experts do recommend that people remain mentally active. We just don't want to oversell that, or have people think that if they do enough Sudoku puzzles that they'll never get Alzheimer's.

Dr. Dave: Yeah.

Dr. Gary Small: On the other hand, we do know that we can train people with mild memory complaints to improve their memory. And so the memory classes that we've developed, the Brain Fitness System from Dakim, even though that hasn't been substantiated yet, the pilot data show that it does improve memory performance, and it probably will when it gets into clinical trials. So I think there're two different types of approaches with mental exercise right now and both have their place.

Dr. Dave: I have some friends who are big into memorizing poetry, and I'm just amazed at all the poetry that they've been able to memorize. I haven't tackled it myself, but it sounds like that might be a very good practice.

Dr. Gary Small: Well, you know I think it's a good practice if people enjoy it. But, somebody came up to me once and said "Small, I took up a language and I hated it, why did you tell me to do that?"

Dr. Dave: Laughs

Dr. Gary Small: I wasn't quite saying...I was saying try different things and do things you enjoy.

Dr. Dave: Yes.

Dr. Gary Small: Because that's another part of brain health is lowering stress and trying to engage in life and have a positive attitude, and those are all good things.

Dr. Dave: Yeah. By the way, what's the spelling of that spice in curry, that curcumin that you mentioned?

Dr. Gary Small: Curcumin is c-u-r-c-u-m-i-n.

Dr. Dave: OK. Well, I'll rush out and buy a pound of it right away. (Laughs.)

Dr. Gary Small: Well, I wouldn't necessarily do that because the challenge we have right now in getting this study going, is if you put curcumin into a pill, it doesn't get absorbed by the brain. But if you cook it in oil, it does. So if you get curcumin supplements you may just be wasting your money right now. It may not do anything for you. Instead, go out and eat Indian food once a week. In fact, one study found that eating curried food once a week is associated with a better memory testing score.

Dr. Dave: Interesting. And I was just listening to you, I got an idea for a cross-cultural study maybe that somebody should do. There are other societies, other cultures which are still more in the oral tradition where people memorize vast amounts of material. And I'm just wondering if you would find less Alzheimer's and memory problems in those cultural groups.

Dr. Gary Small: Well, you know it's an interesting question. The trouble with those cross-cultural studies is that there are so many confounding variables. They've done them—say Hugh Henry from the University of Indiana studied African Americans in Indianapolis and compared them to Nigerians, and he looked at the rates of Alzheimer's and it was lower in the Africans, in the Nigerians. And one explanation is

the diet. That they have a simpler diet. It could also be more physical activity. So there's all these confounding variables, and I find, a lot of times we just have to, you know spend the money and do a clinical trial. To test out these interventions.

Dr. Dave: OK, well let's get into your book iBrain. What was the stimulus for writing it?

Dr. Gary Small: I think, I spent so much time with technology and how we can measure the brain with it. I was just impressed by how much all these new technologies were changing our lives, and I wondered how much are they changing our brains. And that was really what was behind it, the observations in my own life. Seeing my teenage kids very adept with this technology, using it 24-7, but having a concern that it might be affecting their face-to-face human contact skills. And iBrain is really about all these issues—how technology affects our brain, how the young brain is developing and most sensitive to the technological stimulation. And even though the neurocircuits that control the tech skills are quite efficient and these young digital natives who are immersed in the technology from an early age, I'm concerned about their human contact face-to-face skills. Can they look somebody in the eye during a conversation? What about recognizing non-verbal cues, and their facial recognition skills. The older digital immigrants come to the technology more reluctantly, and what I think is happening is rather than a generation gap, we have a brain gap, because their brains are wired differently. And the solution that iBrain offers is to upgrade the tech skills of the digital immigrants and help younger digital natives with their human contact skills.

Dr. Dave: Yeah, that was really kind of a unique aspect of the book I think, is that you try to intervene on both ends of the scale there. Certainly I've noticed changes in myself as a result of technology. It's a very relevant question to me. A big thrust of the book is brain plasticity. And I think you've kind of indirectly referred to that in what you've just said. And I gather you see that as having both an upside and a downside. So maybe you could kind of talk about that—the upside and the downside of this brain plasticity.

Dr. Gary Small: Well the upside is that our brains can repair themselves, to some extent. So let's say that you have a digital native or digital immigrant, who's spending too much time with the technology, their social skills are suffering...you can change that. You can change their computer habits, you can teach face-to-face skills and you can see changes in the neurocircuitry. The positive aspects of technology are clearly there. I mean they've changed our lives, they've improved our social contact skills. We know that surgeons who play video games make fewer errors in the operating room. So, hand-eye coordination is improved. Peripheral vision can be improved. There's a computer program that's being distributed to older drivers in Pennsylvania, hoping that it'll help their driving skills, improve their peripheral vision. The downside is there in many ways. There's technology addiction. There are studies showing an association between too much technology and worse symptoms of ADHD. There's even controversial studies suggesting it could contribute to autism in young people. So I think there's...we know the brain is complex, we know the technology's complex. And what we need to do is recognize the relationship and try to harness the power of the technology so it improves our brains and improves our lives.

Dr. Dave: OK. You use the term ‘techno-brain burnout,’ which I have to say strikes me as a bit sensational, but maybe that’s necessary to sell books these days. But you’re a respected scientist at a respected research university, so give us the scoop on techno-brain burnout, is there some science behind that?

Dr. Gary Small: Well, unfortunately the science is in its infancy in many of these areas, and what I try to do in iBrain is bring in as much of what we know, from neuroimaging, from educational studies, from epidemiological studies and put it together in a way that makes sense. And I think ‘techno-brain burnout’ refers to that experience that we all have when we’ve spent hours searching online or doing email, and...it kind of affects our attention. There’s a level of fatigue, a temporary confusional state some people experience. And it’s something that really hasn’t been studied systematically. But there are other related issues. For example, multi-tasking. We know that has been studied in the middle-aged brain, and may be related to the techno-brain burnout. And we know that middle-agers do not multi-task all that well, and when they’re introduced to a distractor we see more errors than not. And so a lot of people probably should cut back on their multi-tasking. They have the perception that they’re more efficient and they’re doing more, but really they’re making more errors. And it takes time to shift from one task to another, rather than focus on one at a time.

Dr. Dave: Yeah, boy I can really relate to everything that you’re saying about that. I’m a person who spends way too much time on the computer, and I have experienced probably what you’re referring to as this techno-brain burnout, where I kind of hit a wall. Late in the day, usually. And I just hit a wall where I realize I cannot do another thing, I can’t think anymore!

Dr. Gary Small: Well I think your brain and your body is telling you ‘stop,’ and what I’d like people to do, by following some of the advice in iBrain is to kind of gain control of that, so you don’t have to wait for that point where you’re completely burnt out. You know, have proper brain hygiene when you’re using the computer. Take frequent breaks, get up and stretch. I’ve done this myself, where I get kind of lazy and I’m doing the email rather than get up and take a break and talk to someone in the office next door, I just send them another email.

Dr. Dave: Yes.

Dr. Gary Small: Whereas, probably... another thing to keep in mind is what is the best form of communication for what you’re trying to accomplish? I see these strings of email conversations among colleagues, and I’m thinking ‘this is not getting anywhere.’ People can’t keep track of it. Let’s schedule a brief meeting and get together; we can solve this in two minutes.

Dr. Dave: Right, right. Coming out of a university environment myself, one of the impacts that listeners will have heard me refer to before, is when I first started my academic career, as you walked around the university and looked inside offices, you would have seen people talking to each other, you would have seen faculty speaking with students. Today when you walk around probably most any university, and you look in open doors, you see people staring at computers.

Dr. Gary Small: You know, you're so right, and we have a lot of conversations when we're building buildings and planning space to find ways to get people together just...when they have to move from office to office or even just get to their parking garage so they can interact. And a lot of business gets done in the hallway, if we can get people out of their cubicles and out of their offices. But it's not just the workplace, it's the home, and in some ways, the technology is fracturing the family. Everybody is on their own computer, their own device, and they're not talking.

Dr. Dave: Yeah.

Dr. Gary Small: The other day I actually heard myself saying to my son "Harry get off that video game and come down and watch television with me!"

Dr. Dave: Laughs

Dr. Gary Small: So it reflects my concern of too much repetition of a certain computer task, and also wanting him to come and converse. Like the other day, you know I see it in my house though, we got two teenagers, my wife and I, we're all on our computers, doing our work, whatever we may be doing, and the other day a couple of the televisions broke. Maybe the cable was out, I don't know what it was and my wife was away and the kids were upset. I said, "Come on in my room and let's have a TV party." And it was fantastic. I mean we were all watching television, but we had the popcorn and we were having a lot o fun and conversing. And I think that's a difference we see today because, there's so much efficiency and what the computers can do, we all just kind of get hooked into our computer, and we neglect our face-to-face contacts that really define our humanity.

Dr. Dave: Yes, yes. You know, earlier this year there was an article in The Atlantic titled "Is Google making us stupid?" you probably saw it...

Dr. Gary Small: Yeah. And not only did I see it, I actually wrote a letter to the editor on it...because I thought it was a terrific article, but it had a tendency...what a lot of people are doing in this discussion and debate is taking the negative side.

Dr. Dave: Yeah.

Dr. Gary Small: And one thing that's been gratifying to me when I talk to, you know journalists and producers and other writers and scientists is that they like that iBrain is telling us the positive and the negative. It's not all good; it's not all bad but let's understand it and let's deal with it.

Dr. Dave: Yeah. And to wit, your research showing that surfing the web actually has some positive impacts on the brain.

Dr. Gary Small: Well, you know it's interesting because when we did the study I wasn't even thinking of that. I just wanted to try to do a serious study where we could isolate what's going on in the brain when we search online. So to do that we use the functional MRI scanner. We use these special goggles to present to the volunteers a simulated Google search, because you can't get a computer, a real computer into a

functional MRI scanner, the tube is too narrow. And we also presented to them a book-reading page and other control tasks, and it was quite interesting. We found that people who had prior Internet experience showed a much greater activation in the brain when they searched online compared to those who had never searched online. And, also it was much greater than reading a book page.

Dr. Dave: Yeah, I thought that was really fascinating research.

Dr. Gary Small: Well, thank you. And the other thing that was interesting to me that made sense is that the frontal lobe is particularly activated. If you think about the frontal lobe, that's the thinking brain, that's the decision-making part of the brain. And searching online is a very interactive experience. You're constantly making decisions, should I go to this website or that website...and the study really reflected that. And it was interesting the positive take from the media, you know, the headlines were "Google's Making Us Smart."

Dr. Dave: Yeah, right. Now, there are a couple of places in the book where I think you imply that we can take control of the brain's evolution. And I bristled a little bit at that, because doesn't evolution take eons?

Dr. Gary Small: Yeah, I think that in the book I try to differentiate different ways of using that term. I mean, in a sense, 'evolving' can be generic in terms of adapting from moment to moment, and the brain certainly does that. And we saw in our brain Google study that—we haven't published this part of it yet, but—just after a week of searching online, the computer-naïve subjects started looking almost identical, in terms of their brain neurocircuitry to those who had many years of experience. So we could see this rapid adaptation that our brains make when they learn new technology. We also argue that in future generations we will see brain evolution. And the argument is based on how I understand natural selection as meaning the genetic variants that adapt best to the environment will be those that are most successful. So we know the environment is changing. The average young person is spending approximately nine hours a day with technology. So, if that's the case, those who are really good at the technology will have an edge in future generations.

Dr. Dave: Yes, yes. But it might take a long time before...

Dr. Gary Small: Well, I don't know, because I tell you it's pretty rapid in terms of the change in the environment.

Dr. Dave: That's true. The cultural evolution, the whole environmental evolution has been extremely rapid and certainly is impacting us all over the place. Now you've referred a couple times to digital natives and digital immigrants, and these might be terms that are not familiar to listeners, so maybe just give us a little snapshot of that.

Dr. Gary Small: These are terms that were coined about a decade ago to describe the young people who grow up with the technology, are comfortable with it, they multitask, they're constantly communicating online with their social networking sites and text messaging and instant messaging. They are comfortable with the pace of innovation of technology—you get a new device every moment, and they develop

lexicons and special languages, shortcuts that help them communicate very effectively this way. Now the term ‘native’ kind of gives that sense of somebody growing up with a native language, I think there is that component to it. The downside of the natives is that they have some challenges with the face-to-face human contact skills. Something’s got to give, and there was actually a recent study that found that volunteers ages 17 to 23, who were given a task of recognizing the emotional content of a facial expression, that when they played a video game before that task, the ability to recognize the emotional content of the face was diminished. And I think this is the kind of problem we’re facing with the natives. The immigrants are us baby-boomers, who grey up in a time where innovation meant a touch-tone telephone, or color television. The pace of innovation was much slower. The amount of time spent exposed to technology was much less at a young age, and they’re more reluctant to embrace a new technology. Their brains are a bit older when they get it, so they’re not as quick at learning it. So I think it’s helpful to think about these two groups—clearly it’s an oversimplification for many people—and some of the challenges of the natives, the immigrants are experiencing as well, as the amount and pace of technology penetrates their generation.

Dr. Dave: Yeah, yeah and you take a balanced approach, where you outline strengths and weaknesses of both groups, and then you have a chapter or more designed for each to kind of direct them for how they might make up for the deficits of either being a digital native or digital immigrant. For example, you say digital natives lack face-to-face social skills, and you actually have a chapter in your book with advice on getting to what you call ‘Empathy 2.0’ among other things...

Dr. Gary Small: Yeah,..

Dr. Dave: What’s ‘Empathy 2.0’?

Dr. Gary Small: Well, what I try to do as a psychiatrist, I try to figure out what are some solutions to these problems and what do we know about...another form of technology, and that is how we can teach people to be more ‘human.’ And there are some exercises that people can do to improve their empathy skills, for example. We know that young people, their ability to empathize, to understand the other person’s emotional point of view, is not as good as a middle-aged person’s. So teenagers are still developing their empathy skills, and there are ways to try to help people understand that, using simple exercises. Another area that’s important has to do with frontal lobe executive skills. Teenagers have not really fully developed their frontal lobes, and I can tell you that’s the case, I just taught my teenage daughter how to drive—I had jet-black hair about six months ago...

Dr. Dave: Laughs

Dr. Gary Small: ...and now it’s getting a little bit grey. So it’s “Dad, whatever, I saw that car coming.” You know, she doesn’t, like many teenagers, it doesn’t come natural to think ahead and anticipate and those are skills that are still being learned. And I think that’s a concern is you have all this technology that’s unregulated. Kids playing hours and hours with these video games, are they going to lose some important developmental milestone that needs to be reached at a certain age? You asked earlier about plasticity—the young brain, and the teenage brain is still

developing and there's this process called 'pruning' where 60% of the synapses, the connection sites between the neurons, are being pruned away so these neural circuits are being shaped during a critical period.

Dr. Dave: I don't know if you've looked into Second Life at all, I don't think that was mentioned in the book...

Dr. Gary Small: Well, it actually was, it might have been in the technology chapter or the culture chapter, you're familiar with this game or you just read about it?

Dr. Dave: No, I've gone into it; I actually have an avatar there.

Dr. Gary Small: Oh my goodness—tell me about it, what's the experience like for you?

Dr. Dave: Well, it's very exciting initially, because these avatars really...everybody looks wonderful in Second Life. Women are sexy and curvaceous, and all of the men are hunks, and...

Dr. Gary Small: Laughs. So it's a way to kind of reach our ideal persona. For those unfamiliar with it, it's basically a game where you're interacting, these avatars are interacting. Hopefully, you're not one of these people, but there are people who spend 12-14 hours a day in this Second Life game.

Dr. Dave: Yeah, I burned out on it pretty quickly. It's not really a game; it is an alternate environment, an alternate reality, that somewhere in the neighborhood of a million people are involved in across the world.

Dr. Gary Small: You know, I first was introduced to it, I was flying over the Atlantic and there was a documentary about it, where there was a married couple that was playing this game with other people—separately playing it. And the husband wanted to go meet the avatar he had actually married in the game, and that was what the documentary was about. So what's interesting is that there is almost a confusion between what becomes real and what becomes part of the virtual world. We've seen this in other areas. I've been talking to schools, and one of the schools, one of the parent groups, they decided to have a day without technology for the high schoolers. Most of the kids couldn't last through noon.

Dr. Dave: Laughs

Dr. Gary Small: And when I talked about iBrain, we had a panel discussion and some of the kids were saying "Gee I'm doing my homework at night and I'm on my Facebook and sometimes I can't tell which is which."

Dr. Dave: Well, part of the reason why I brought up Second Life is we can imagine that virtual reality will get more and more compelling, more and more realistic, and so...

Dr. Gary Small: You know, it's an interesting speculation because I agree with you, if we continue the way we're going, the technology will really become seamless with Shrink Rap Radio #188, Technology and the Evolving Brain, with **Dr. Gary Small**
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reality. I mean you may go to the doctor and you may not be able to tell, is that a real doctor or a virtual doctor?

Dr. Dave: Right.

Dr. Gary Small: The other issue is –how is this going to affect how we understand our culture? Literary reading is on the decline as the technologies take hold. And in the future, actually the next generation of digital natives may say, “I don’t really...I can’t get into a novel. I can’t perceive what’s going on in that protagonist’s head. I’d much rather play a video game.” So we may have, rather than novels, we’ll have video games with elaborate narratives.

Dr. Dave: Yes, yes and I’ve been referring to Google as ‘a prosthesis for my brain’. It’s become so integrated into my life, our lives, you know. I mentioned I have an iPhone, and so when you’re out with people, any question that comes up, you know where you don’t know something, you can’t remember a character in a movie or there’s some historical question or something, out comes the iPhone or whatever smart phone the person has, you get right on to Google or Wikipedia, and there’s the answer. It’s mind-boggling that we have access to....

Dr. Gary Small: Yes, it’s mind-boggling, but the question is, is it changing how we think? Are we sacrificing depth for breadth? In other words, we have a new generation that’s constantly getting new information that they want from moment to moment then they can search online and that’s it, and they move on, rather than looking at questions in detail and trying to understand them. Also, are they learning delayed gratification? If you can get whatever you want, talk to anyone you want to from moment to moment, are we becoming less patient?

Dr. Dave: I know that I have become less patient as a result of my close relationship with technology.

Dr. Gary Small: Yeah, so think of it—you and I grew up in a generation where we didn’t have these tools. We’re suffering from these symptoms, what’s going to happen with this new generation that knows no other world?

Dr. Dave: Yeah, these are very relevant questions I think. You have a chapter on addiction to technology, and I’m under the impression that experts have been somewhat divided as to whether or not the Internet and other technologies can literally be addictive, but you actually outline some relevant brain mechanisms that suggest that, yes there is an addictive quality.

Dr. Gary Small: Yeah, I think it is. I think it would help the field move forward if we could reach consensus on this. There are some books on Internet addiction, and if you look at the behaviors, if you look at people who have addictive personalities, there’s the same dopamine neurotransmitter system, that primitive reward system in our brain, that operates. Many people have gone from addiction to, you know they go from food to shopping to drugs, alcohol, why not to technology? And you see many people suffering with it. In Asia, there are specialized boot camps, or addiction centers to help teenagers who are addicted to video games. You know I’ve gotten some heart-wrenching emails from people who have heard me speak and gotten the

book, about you know, their kids who are virtually locked in their rooms with these technologies and they can't get out. Tell me that doesn't meet the criteria of an addiction.

Dr. Dave: Yeah, I was intrigued by that mention of the Chinese government and their boot camps, and you gave a statistic of about 2 million youngsters in China who were estimated to be addicted in that way. And you also said that the American Medical Association has recommended additional study to determine whether video gaming and Internet addiction should be considered official diagnostic categories.

Dr. Gary Small: Yeah, and I don't know where the debate is, I know there's DSM work groups right now, I'd be curious as to where the addiction group stands on the technologies. Whether it's officially recognized or not, it's out there, and people need help, and I think the addiction specialists are recognizing it.

Dr. Dave: Yeah. You also noted somewhere in there that TV is bad for the brains of toddlers. What are the brain mechanisms there?

Dr. Gary Small: Well, this is something that's been studied in many epidemiological studies, and there's an association. You find that there's worse symptoms of ADHD associated with more video and TV time, and...there's been some debate about it, in terms of a true causal relationship. But it's been enough of a concern that the American Academy of Pediatrics recommends no technology for kids under 2. I think it needs to be looked at, and certainly in young people we've seen many improve when they cut back on their technology time. And I'm sure there are some, where their brains are not as sensitive.

Dr. Dave: In your final chapter there was something that really caught my attention. You touch on 'future brain' and brains interfacing with computer chips and so on. And you even talk about a currently existing 'neurochip.' I hadn't heard about that, tell us about that.

Dr. Gary Small: Well, you know it's quite interesting. Nanotechnology is really quite an exciting area where they...I've seen individual heart muscles turned into machines, where they have a little lever and the heart muscle dances around the Petri dish. And we can take individual nerve cells and begin to monitor them. And you know I think in the future we may actually have these neurochips in our brains that help augment our memory or treat brain diseases and may be even used to make us smarter and more seamlessly connected with the computer. Lower end technology that's already coming into play is the brain-computer interfaces where they have sensors on the forehead or scalp and volunteers can control a computer just by thinking about them.

Dr. Dave: Yeah, and I think they either have developed or are in the process of developing assistive devices for people with various paralyses and handicaps, to help them overcome...

Dr. Gary Small: Yeah. A lot of these technologies develop out of the disease arena, but they can also be used to enhance our abilities.

Dr. Dave: Yeah, and of course video games will also drive those technologies...

Dr. Gary Small: In fact there is a video game company that advertises the headgear right now for controlling your game. Now whether it's just the person moving their forehead muscles and scalp muscles, or whether it's truly reading their minds remains to be proven.

Dr. Dave: Uh-huh. Well, as we begin to wind down here, I'm wondering what research you see is really needed. Let's say NIH or some other body gave you a grant for I don't know what a large amount of money is in this arena,,,

Dr. Gary Small: Laughs

Dr. Dave: ...let's say a hundred million dollars...

Dr. Gary Small: (laughs) Wow, now you're talking!

Dr. Dave: ...to set up a research project of your choosing. How would you spend that money?

Dr. Gary Small: Well, you know, I think I would take what we're doing to the next level. I think we do studies understanding how the technologies affect our—we'd use a lot of Functional MRI which is a great tool to understand how it affects our brains. And I think we'd look at developing technologies to improve our brain function. And this is an area that's already beginning with cognitive training, but I think there's so much opportunity here, it would be very exciting to create a center or an institute that took iBrain to the next level in terms of research.

Dr. Dave: OK. Well, we're kind of at the end of our time here. Is there anything else you'd like to leave our audience with?

Dr. Gary Small: Well I would say, try not to get too strung out on Second Life,

Dr. Dave: Laughs

Dr. Gary Small: ...enjoy the technologies. I think I have a lot of enthusiasm and optimism that we can harness them to improve our lives, to upgrade our tech skills and maintain our human contact skills. Because I think the people who will really excel are those who master both and know when each makes sense.

Dr. Dave: Alright. Dr. Gary Small, thanks so much for being my guest on Shrink Rap Radio.

Dr. Gary Small: Thank you, I really enjoyed it.

Dr. Dave: I hope you enjoyed this interview with Dr. Gary Small. As he was talking about the dangers of technology addiction and getting his teenagers to take a time out from their techno-toys, it put me in mind of one of my sons when he was that age. If ever there were a video game addict, he was it. This was something we used to worry about quite a bit. He wasn't dating; he wasn't socializing much beyond through the computer.

Now he's 27 years old, and things are working out quite well for him. He's married to the girl of his dreams, a real beauty, whom he had to pursue for several years, but he finally won her over. They have a nice little cottage in a woodsy area about 45 minutes away from here. As a result of his comfort with technology, he's ended up with a fairly high-paying job in which he's responsible for managing millions of dollars of just-in-time inventory, using the Oracle database software among other things. He has jumped over some people with more longevity and he's now their manager, despite the fact that he hasn't quite finished his undergraduate college education. However, he's of course doing that online and loving it. Traditional education had not been a successful arena for him, but he's thriving in the online environment and very proud of the high grades he's racking up there.

When Christmas and birthdays roll around, it's still various pieces of technology he wants, faster motherboards for game playing, bigger monitors and so on. Still, he doesn't spend nearly as much time holed up with video games and from what I can see, he's having a very happy marital relationship, loving living in the woods with wife, dogs and cats. Sure, I might have wished a more straight-lined path through college for him, but we each have to find our own way, and at our own pace. I'm proud of him and what he's making of himself.

I offer this personal vignette for any of you who may have seemingly techno-addicted kids to suggest that it may serve them in ways that you can't presently foresee. This is not to deny the pitfalls Dr. Small outlines in his book, yet most of these digital natives will probably come through with flying colors.