Shrink Rap Radio #475
The Social and Psychological Impact of AI and Robotics

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Dr. David Van Nuys, Ph.D., AKA "Dr. Dave," interviews John Markoff

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Introduction: My guest today is John Markoff, Pulitzer Prize-winning, *New York Times* science writer, and author of the 2015 book, *Machines of Loving Grace: The Quest for Common Ground Between Humans and Robots*. For more information about John Markoff, please see our show notes on www.ShrinkRapRadio.com

Dr. Dave: John Markoff, welcome to Shrink Rap Radio.

Markoff: Thank you for having me, it's good to be here.

Dr. Dave: Well it's been about 34 years since you interviewed me for *InfoWorld* on the future of video games, so it's nice to have the opportunity to return the favor.

Markoff: That's neat. 34 years has been a while.

Dr. Dave: Yeah really. But I've been following you. We were both very young in our careers at the time. As I recall you approached me because I was both a psychology professor and a market research consultant who had done research for the likes of Atari, Apple, Electronic Arts and so on, and you know, I looked back at the interview you did with me then, because I kept a copy for my archives, and I'm happy to report that all my predictions about the future of video games came true.

Markoff: I've forgotten, what did you predict?

Dr. Dave: Oh let's see, I think I was – you know it's been a little while since I looked at it to check, but I think one of the things I predicted was, possible use for educational purposes and training, and certainly we've seen it move in that direction. And I forgot what other wonderful predictions I made. I should have brushed up on that – actually, it occurred to me that you might ask me that. By the way, I see that you're a Pulitzer Prize Winner, please accept my belated congratulations.

Markoff: Thank you.

Dr. Dave: Yeah, what was the work for which the prize was awarded?

Markoff: Well there was a series of stories that appeared in the *Times* in 2012, largely about Apples' manufacturing practices in China. The piece that I wrote was really about the future of manufacturing and dealt with AI and robotics.

Dr. Dave: OK, that's right on point and I remember that there was a big flap about that and there was a story on *NPR* that later was retracted – I'm sure you probably are aware of all that, right?

Markoff: That's right. There was a lot of controversy around it and I tried to go to China during that period. I was interested in the use of robotics in China, and because of the situation between the *Times* and the Chinese government, I was not able to get a Visa. So I ended up going to Europe instead.

Dr. Dave: OK, that's not too bad.

Markoff: No, it worked out OK.

Dr. Dave: Now I don't know whether to hope that the predictions, speaking of predictions – I don't know whether to hope that the predictions in your book come true or not. I very much see your book like Rachel Carson's *The Silent Spring,* which alerted us to the coming ecological disaster, and you are sounding a strong warning about a potential technological one. That just occurred to me this morning as I was dipping back into the book.

Markoff: Yeah I think that's fair, although I'm much more of two minds. You know, I can see several outcomes and I'm not entirely pessimistic. I mean I wrote the book because I see designers – human designers – having so much of a role in the outcome, which I take as a potentially optimistic possibility.

Dr. Dave: Is it *Pogo* who was quoted as saying, "I've seen the enemy and they are us?"

Markoff: Exactly. That's very true.

Dr. Dave: Yeah and it seems particularly appropriate. Again that came to me as I was dipping back into the book this morning. Well, the title of your book is *Mad* – [laughs] – is *Machines of Loving Grace*. I almost said "madness --" I think there might be something Freudian going on there. *Machines of Loving Grace: The Quest for Common Ground between Humans and Robots,* which I have to say I was thrilled to discover, because before I heard about it I was already editorializing about robots in my monthly newsletter as a result of recent films such as *Her, Ex Machina*, and *Tomorrowland*, as well as hearing an interview with Martin Ford, author of the book *Rise of the Robots.*

Markoff: That's right, it seems like it's everywhere, doesn't it?

Dr. Dave: Yeah it does, and robots have been very much on my mind. I'll tell you a funny story: when I was in graduate school I was doing a clinical psychology internship at the VA hospital in Allen Park, Michigan. I received a letter from someone who I did not know, from outside the system somewhere, telling me that in my past life I had been a robot-maker in Atlantis and that in this incarnation my purpose was to work out that karma [laughter]. And it seems kind of amazing reflecting back on that.

Markoff: That seems reasonable.

Dr. Dave: Yeah in some ways it seems like it could be true. The way I discovered your book was your *NPR* interview with Terry Gross, and so I immediately reached out to contact you after

hearing that interview and I was very gratified that you responded positively. And I have to say, reading your book was like candy for me, which is to say I gobbled it up; technology has always been a big part of my own passion. I really am reflexively a technophile, even though in recent years I've started to reflect on the shadow side of technology and some very good books that were written ten or fifteen years ago that started getting my thinking going in that direction. In her interview, Terry focused most of her attention on your chapter about driverless autonomous automobiles – and just another little story -- I was on a long walk with my seven-year-old granddaughter and kind of out of the blue she said, "You know, my first car is going to be a –" I don't remember the word she used but it was essentially driverless. I don't know where she got that idea and I thought, "My God, she could be right!"

Markoff: Today there was a story saying that the Apple's first electric car will come in 2019.

Dr. Dave: Uh-huh.

Markoff: So maybe she'll have an Apple.

Dr. Dave: Yeah they'll have the kinks worked out by the time she's ready to drive. So since I'm sure my listeners can find that interview with Terry Gross by searching on the web, I'm going to focus our conversation mostly on some of the other topics in your book. And if you feel absolutely compelled to talk about driverless cars, feel free [laughs].

Markoff: Let's go elsewhere.

Dr. Dave: OK. And of course, me being a psychologist as well as a market researcher still after all these years, this is a psychology podcast, so as we go along I'm interested in the psychological and social aspects wherever they might apply. And also I was both gratified and horrified to see that there were actually several psychologists mentioned in the history as you recounted it, some on one side, some on the other. So to jump into it, the big theme that runs through your book, we might characterize as AI versus IA, so perhaps you can unpack those initials for us as well as their significance.

Markoff: Sure. The observation that was my starting point for this book really grew out of a book I wrote a decade ago called *What the Dormouse Said: How the Sixties Counterculture Shaped the Personal Computer*. And at the time there were two laboratories in the 1960s, two computing research laboratories that were both created in the early 1960s. One was created by a man by the name of John McCarthy, and McCarthy had coined the term "artificial intelligence" in the 1950s and he really was already one of the most significant figures in the computer industry. He came to Stanford in '62 and proceeded to create a research lab called the Stanford Artificial Intelligence Laboratory. And he believed in '62 that it would take him a decade to create a working AI – basically displace humans – to build a machine to do everything that a human would be able to do. And then on the other side of campus, there was another laboratory created by a man by the name of Doug Engelbart. Engelbart in '62-'63 set out to create a laboratory called the Augmentation Research Centre. You probably know Engelbart because he was the inventor of the computer mouse and he invented hypertext which led to the World Wide Web, and he really took it upon himself during the 1950s to make it his life's goal to use computing to build technologies that would augment human intelligence. He really thought he could build tools for small groups of human workers to make them more effective and to sort of be an

intellectual prosthesis for the humans. And I realized ten years ago those were two different philosophical approaches. And in fact in the intervening period between the 60s and today there have been these separate communities within computer science – the AI community, and then Engelbart coined the term "intelligence augmentation," and that became the human-to-computer interaction community. Lots of psychologists on both sides of the fence, you know, cognitive scientists doing both and I realized that the puzzle that I was trying to solve in writing this book was that there's a dichotomy between those two worlds but it's also a paradox, because even when you augment human intelligence, you potentially displace humans as well. And I really don't claim to have an answer but I do think it's rooted in human design, wherever that answer is. And I looked at a group of people, a number of people who were designers on both sides of the coin – and particularly people who crossed over from AI to IA; I was very interested in that.

Dr. Dave: Yeah, yeah, you know you mentioned prosthesis and I only have-jokingly tend to refer to Siri and particularly to Google as a prosthesis for my brain [laughs]...

Markoff: I agree.

Dr. Dave: ...which I increasingly rely on.

Markoff: Well you know, and it was Steve Jobs – and probably somebody coined this phrase first—but Jobs referred to the personal computer as a "bicycle for the mind," and I think that's a wonderfully evocative phrase in the best sense of the potential of personal computing.

Dr. Dave: Yeah, me too. I was fascinated by the issue that you raise in terms of whether digital technology will be used to replace humans or to assist humans, and that's basically what that dichotomy is about. And it never occurred to me to think about it in those terms, and I guess one of the main points of your book is that it may not have occurred to at least some of the people who are designing these systems. Do I have that right?

Markoff: Yeah well I think it's a matter of orientation and values. And you know, there are people who I spent time with who are really captivated with the Engelbartian idea and values, a number of people who really put the human at the center of their design. And then I also increasingly found a number of people in my research who are influenced by science fiction, science fictions movies – I can't tell you how many people I've stumbled across who decided to go into AI because they saw *Space Odyssey 2001* and they wanted to build Hal, which was not my reaction...

Dr. Dave: [Laughs] Yeah, right.

Markoff: But you know, people like Rod Brooks and Jerry Kaplan, both well-known early people in robotics and AI, they really were inspired by that movie. That was very striking to me, how science fiction and the visions that it creates of the world, that it can actually affect the actual world, and I saw that.

Dr. Dave: You know, speaking of science fiction, I remember that you cited two science fiction books that you thought were maybe the best around on this topic and now I can't find that reference. Do you remember those two topics?

Markoff: I wonder if I was talking about -- I have some favorites, I don't know which particular topic it was, I mean certainly *Bladerunner* as a movie was very evocative and in terms of books, both *Snow Crash* and *Neuromancer* were all important books.

Dr. Dave: Those aren't the ones, I've read both of those.

Markoff: I wonder which two I – at this point I'm not sure what I was specifically...

Dr. Dave: OK, I'll just have to go back. Maybe a novel is in the index, I don't know... I hope [laughs]. Or science fiction, maybe it'll come up under that.

Markoff: I'll think some more while we're talking.

Dr. Dave: OK, well before we go any further, I should probably get you to say something about the difference between robots and artificial intelligence, inasmuch as the subtitle of your book is the quest for "Common Ground Between Humans and Robots," and yet most of the focus of your book is on artificial intelligence. I know there's great overlap but what would you like to...

Markoff: Well – so you mean about robotics in particular, or --?

Dr. Dave: Well I guess what I'm getting at is, is I want to make sure that our audience understands that robotics refers to those more or less human-looking things –

Markoff: Yeah... although a self-driven car I would call a robot. I mean I have a very broad definition of robotics, and if you try to find formal definitions, it gets messy, I mean, there are some people who believe that a robot is only a device that is autonomous and yet in conventional idiom, we refer to teleoperated devices as robotic too, and I've chosen to take a broad brush, so even Siri, I consider Siri to be a software robot.

Dr. Dave: Mmhmm, right, exactly.

Markoff: Or you could call it an AI of some kind. The terminology is not precise, I think is the way to describe it.

Dr. Dave: Right, right. And you point out that the tension between systems designed to replace humans versus systems designed to augment our abilities has a long history and you've already told us about Doug Engelbart and John McCarthy. Also Marvin Minsky was I guess on the McCarthy side and –

Markoff: More so... He was a little bit nuanced but yeah he was close to McCarthy and they both created the first two laboratories, you know. McCarthy and Minsky built the MITAI lab before McCarthy moved east, and Minksy's continued to write about the subject of building machines that replicate all human capabilities.

Dr. Dave: I don't know how you wrapped your mind around this huge topic because your book really is like a history book, because there are names of people, I think on every page. I'm not sure I encountered a page that didn't name some of these leading characters, and often we were coming back to them, you know, we'd read all about them we'd thought, in one chapter, and then the next chapter: "Oh here they are again!"

Markoff: Yeah, so that's probably a fair criticism. There was also, I thought, a fair criticism of my previous book that is that you know, after I started *Dormouse*, I realized that it probably would have been easier to synthesize everything if I'd made it a biography of Engelbart. But when I started, I realized that there was another biography already been written and I sort of shied away and then I realized that there still needs to be another great Engelbart biography written, which hasn't happened yet. In the same token, I came to this book, and I originally started it as just two stories of two people that I thought embodied these ideas of IA and AI, and then at the last moment, fairly far into the project, one of them refused to cooperate with me.

Dr. Dave: Oh no! [Laughs].

Markoff: And so for a while I was slightly suicidal and then I decided that I need to finish this and that the two ideas were strong enough, and I think that's why you see so many examples, as I was trying to be, you know, thematic and focused on the ideas and use these people and their decisions and what they did as the basis for illustrating this dichotomy.

Dr. Dave: Yeah, well it was an effective approach, I think, and it really brought home the key ideas being illustrated over and over again in different kinds of settings. One of the concepts that you cover is "liberation technologies": an interesting phrase, reminds of liberation theology. What can you tell us about that?

Markoff: Sure. So that was a group that was created by a couple of scientists from diverse areas: social scientists and technical scientists at Stanford, and it's still an active group, and it fits within the field. The modern academic part of that field is called "human-computer interaction." And that's human-centric design, and I think what the folks at the liberation technology group at Stanford have done, is they've tried, if you will, they've tried to socialize the idea, they've tried to explore human-centred design within a political context and it's very much part and parcel of Terry Winograd and his view of the world. Terry was a pioneering AI designer who in the 1980s basically gave up on the field and walked away and he pursued a very different direction which was around human-computer interaction design – HCI – and you know, there's a political component to their work as designers; they want to build systems that invoke and support community in addition to just purely technical design.

Dr. Dave: Yeah, yeah, thank goodness that there are people like that, reminiscent of the early days of computing and the Apple II and all of that, and the idea of empowering us which certainly it has done in many ways. The other side of the coin is captured very powerfully when you write – and there's so many great quotes, I mean I was marking my book up like crazy – but there are ones where you really sock it to the reader. You write, "The new ethical dilemma is: will humans allow their weapons to pull triggers on their own without human oversight?" You want to say something about that?

Markoff: Sure, I can say a lot. So, there is an international political movement now called "The Campaign to Stop Killer Robots," and in some ways it is a successor organization to an organization of computer scientists that was created in the 1980s – and was actually created in part by Terry Winograd, called "Computer Professionals for Social Responsibility," that embodied this notion of the human in the loop, and the ethical judgments that the human in the loop should make. You know the organization – the campaign to stop the killer robots started now because we're starting to see a generation of new kinds of weapons systems that basically

separate the killing from the human being. Not the victim, but the killer. And so in the United States now, more than half of the military air vehicles are teleoperated drones.

Dr. Dave: I didn't know that. More than half...

Markoff: More than half. They have thousands and thousands of drones, like Predators and Global Hawks and all kinds of other vehicles and those are largely now still human controlled, although it's really quite striking – one of the surprising things that I've found in studying one of the weapons systems called "The Predator", which is now used all over the world to extend the reach of the American military -- is that in any Predator mission there may be as many as 150 to 170 humans involved, everything from intelligence analysts to pilots to lawyers who oversee decisions on killing.

Dr. Dave: Wow.

Markoff: And so far, those are what you would call semi-autonomous weapons – the weapons themselves don't decide who to kill or where to kill. The United States in particular does not have at the moment any purely autonomous weapons in our arsenal; we are designing a weapons system called LRASM – Long Range Anti-Ship Missile – that's designed for the Pacific Military theatre. I think it'll be deployed probably in 2018, and it's a what's called a semi-autonomous weapon, in that it's got to fly from a carrier from an aircraft perhaps five or six hundred miles and in the last 300 miles it does it without any contact with humans or networks or anything else, and the reason they call it semi-autonomous is that a human picks the target. But then when it gets to the enemy fleet, it will use AI software to decide where the target the human specified is. So it's a slippery slope.

Dr. Dave: Mmhmm.

Markoff: You know, if you think about autonomous killing, a landmine is an autonomous weapon; it's just a really stupid autonomous weapon.

Dr. Dave: Uh-huh.

Markoff: But you can see what these weapons, because of the falling costs of computing and the falling cost of sensors, and increasingly more powerful sensors, these weapons are going to be ruthless, whether we like it or not. They're just too easy to design and you know, I'm actually tremendously concerned about the deployment of those technologies for a lot of reasons: one is, I think, that has not been widely discussed is, if you think about these weapons systems in the hands of small dictatorships, it will make it easier for a dictator to control a population, even to the point of – think about putting face-recognition technologies on airborne platforms, to look for humans on the ground below. I'm virtually certain that will happen. In effect it probably is already happening today with the U.S. using various communications technologies to track people. And face-recognition would just be an additional mechanism. And I think that's as close to Terminator as you can possibly imagine without assuming self-aware machines.

Dr. Dave: Yeah, you know I think based on what I read in your book that the only thing that doesn't exist already in the Terminator scenario is time travel [laughter], where the Terminator is coming from the future. But you actually explicitly say that all of the components of the Terminator

scenario, like robots that can climb ladders and robots that can bust down doors, etc., and certainly robots that can fire weapons... but all of that already exists.

Markoff: So there's a distinction I'd like to make in terms of that: I don't think we're close to actually designing what are called self-aware machines yet. Certainly there's lots of autonomy – and I make a distinction between autonomous systems: machines that can make decisions, and machines that actually think in a human sense. And I don't think we're anywhere near humans that think in a human sense – at least the Terminator in the science fiction movie appeared to be a self-aware machine.

Dr. Dave: Yeah, yeah. OK, I'm also struck by another powerful quote: "Artificial Intelligence is poised to have an impact on society that will be greater than the effect that personal computing and the Internet have had, beginning in the 1990s. Significantly the transformation is being shepherded by a group of elite technologists." You want to talk about that?

Markoff: Sure –

Dr. Dave: [Laughs]. Your whole book is about that!

Markoff: Exactly right. And you know, at this point, I think I have to say that that point about AI and robotics versus personal computing and the Internet is a reporting hypothesis on my part. I mean I made a bet that this was going to be a very big deal. And I have a good friend, Paul Saffo, who's been a long time observer in Silicon Valley, and one of the things that Paul says is, "Never mistake a clear view for a short distance." And so the time frame is one that I go back and forth on, and I think it's really one of the foibles of Silicon Valley, is we think that people who spend their time in Silicon Valley have a real faith that these technologies are all accelerating and that the future is going to be here quicker than we might have imagined, and you know, I think it's patchy; there will be advances in some areas and not in others, and so I can see the impact of AI, for example, on the work force, and I'm watching a very, very lively debate about how widespread and how quick the impact will be. And I started in one camp – before I wrote the book I was one of the first people to write about, beginning in 2010, about the new impact of AI technologies on skilled jobs like lawyers, doctors, things like that. And that said, the reality is that these things may take longer to arrive than some people expect. I mean, now there's a whole – Martin Ford is a great example -- a whole school of people who believe, essentially, the point of view of a computer scientist like Moshe Vardi, who argues that virtually any human task will be within the grasp of a computer or a robot by 2045. I'd actually become more skeptical that those changes will come that quickly. I think there will be dramatic things that will happen but I think that there will be plenty of work for humans throughout our lifetime – yours and my lifetime at least.

Dr. Dave: Yeah I want to discuss that a little bit more. More and more of the stores where I shop – and I'm sure for you where you shop – are replacing the checkers of cash registers with do-it-yourself checkout stations, and I always avoid the do-it-yourself option - which shows you where my ethical concerns are - whenever possible, because I don't like the idea of putting people out of work. So I've tended to demonize the approach that puts people out of work, but you managed to achieve a more balanced point of view, so maybe you can tell us something about the pluses and minuses there.

Markoff: Well I'm actually very sympathetic with your point of view; I'm not sure that we actually disagree. You know, I think that that system that you're describing where they force you to do your self-checkout, I think that's actually an interim stop and that my sense is that the cost of sensors and the RFID tags that now are starting to be on everything, is coming down quickly enough that probably within the decade you will simply walk out of a store and the checkout process will happen as you walk out.

Dr. Dave: OK, yeah, that's certainly conceivable.

Markoff: And so, what about those jobs for checkers and you know -- it's a huge category of the workforce and I think that that is actually one that I could see a scenario where it might vanish in the brick and mortar world and they might be replaced. You know, there will be more people who would be there to assist you, rather than to charge you, there would be sales associates, so there wouldn't be an absolute vanishing of all human contact. There would probably be maybe even more human contact, but the role of the people in the purchasing process would change.

Dr. Dave: That's a bit optimistic I think, because when I go to Costco that's not what I see.

Markoff: Exactly. And when you go to Amazon that's not what you see either, right? That's another model. It's complicated, is what I keep saying. For example, let's look at what's happened in the world of ATMs and human tellers. Because, in fact, even though President Obama said in 2011 that there were fewer human tellers because of ATMs, that's not what's happened. What's happened is because of the falling cost of telecommunications and computing, there are now banks on every corner you could imagine, you know, it's like Starbucks, they're everywhere. And so as a result, the number of human tellers has actually stayed flat and what's vanished are the people in the back office, it's like a neutron bomb has gone off inside the bank and all those people who move checks are gone. So there has been a huge impact.

Let's do a thought experiment on another type of employment that could be easily replaced by technology, and that's the barista. Try to imagine a Starbucks without any humans in it and what it would do to the experience, and whether people would go to Starbucks, even if they could get a nice latte or what-have-you... and I actually think that it's a more complicated problem than just saying, "OK this job can be done by a machine, that job's gone." In that Oxford study that came out recently that tried to rate the percentage of every job category and what chance they'd end up being eliminated, and I think they came up with an aggregate number that 40% of all jobs were at risk within 20 years or something like that. And when I began to look at the job categories I just thought, "This is ridiculous." For example, one of the job categories that they said was 98% likely to be eliminated was pedicurist and manicurist, and I just think that's ridiculous. I don't know if I'd be the first one to offer my fingers or toes to a....

[Laughter]

Dr. Dave: Yeah but they're using them for surgery. How about your spleen or –

Markoff: Well those are teleoperated, remember? That's an example of IA, OK? You can use robots to basically extend the capabilities of humans and I think Intuitive Surgical is the best example of that for your spleen. The human surgeon can operate with being less invasive in principle, and operate inside your body. I've gone and visited Intuitive and I've seen their next

generation surgical robots, and what they've focused on is not automation, but on augmentation. The coolest thing about the next generation of intuitive surgical robots is they have great vision, and so the surgeon can see inside the body in ways they never could. I think that's very neat. So once again it's a design issue.

I think that the evidence on what's happening in the work force, in America, is extremely murky. I read the debates between the economists over job displacement, and I am yet to be convinced that those kind of things that Jerry Kaplan and Martin Ford -- who are both friends of mine, and I've read both books and I think it has to be proven. I don't think it's a certainty that that will happen to the workforce. So what they believe will happen to the workforce will happen on the time frame that they say. For example, let's talk about the job of a driver. 3 million people make their living from driving trucks, taxis, in America. I do not think that that jobforce category is going to be dramatically affected in the next decade, despite Uber's investment and Google's investment. I think that the edge cases and the issues of liability is tremendously an unsolved problem at this point, and not clear that it will be solved in the next decade to me.

Dr. Dave: Mmhmm. You know, another issue that was brought up, called "shadow work," by Craig Lambert, who has written a book about that referring to the unseen, unpaid jobs that fill our day. So I'm thinking of that checkout scenario, where I have to go and figure out how to run my products over the scanner and get my card in and all of that, which they say is going to go away -- but there's so many places in our lives now where it seems like more and more work is shifted to us that used to have people. As a professor we used to have, they used to be called secretaries and then they were called personal assistants, but what the wonderful computer did was to – [laughs]... I used to play tennis with my students and kinda hang out and be available. When I go to the University today and I look around, everybody is staring at a screen... everybody is staring at a screen, and I found – I'm now retired from the University -- but I found that I had less and less of that hanging out time because now I was so empowered [laughs] to do my own typing, publishing, blah, blah, blah... it was taking up all my time.

Markoff: It's a great point. Did you see the *Times* piece about Amazon and the new form of measurement of employment? There was really a striking piece about the work culture at Amazon.

Dr. Dave: Yeah I think I did see it, but take us through it again.

Markoff: Well so, the piece sort of probed the culture of this very intense workplace, and I think probably you could say it for many companies in Silicon Valley, it's not just Amazon, but in Amazon in particular, was an example of the kind of – remember the – I'm forgetting the name of the Charlie Chaplin move in the 1920s about –

Dr. Dave: I'm not that old [laughs].

Markoff: We all saw this when we were growing up, there's a Charlie Chaplin movie that focused on automation.

Dr. Dave: Yes I do remember that.

Markoff: And, you know, this notion that you can measure every aspect of a person's productivity and somehow improve it by keeping an incredibly detailed record of it, and of course the sensors

that we have now make that possible; you can instrument everything that a human does, and you know, it creates a grim world, right? Kind of, describing where we work all the time, not clear that productivity goes up, but we're instrumented... I mean that's one of the interesting things, there's a huge debate right now about productivity in American society and you'd think, given all this technology that you'd see this exponential...

Dr. Dave: Yeah.

Markoff: It's actually episodic. It's very much a puzzle, it comes and it goes and there's a debate: some people believe that they can't measure it correctly anymore and then there's this technology that you've mentioned. For example, what's the productivity impact of having access to Google? No-one knows how to measure what impact it has... that's a fascinating discussion. But I don't think that there's clear evidence on productivity or what's going on with the structure of the work force even. The more I read the more confused I get.

Dr. Dave: [Laughs]. Great. OK, and let's see here... so, as robots, another source of artificial intelligence, take over more and more of our work, it seems inevitable to me that large numbers of people will be displaced from the workplace and I've complained that we don't have an economic model to support that situation – our economy, even as it exists today, guarantees – then this is the Marxist critique – that a certain percentage of people will be unemployed, but there's a huge stigma attached to receiving government aid, so I've for some time thought that we need an economics that somehow acknowledges the fact and de-stigmatizes government aid. What are your thoughts about that?

Markoff: Yeah, so let's see... first of all, it's the issue of the Marxist critique, because it's interesting that the new technologists, and in their view of the impact of automation technology is very Marxist. I mean overproduction and unde -consumption is their vision – I've come to a much more Keynesian view of things: remember Keynes in the 1930s sort of asserted that technology destroys jobs but not work, and his argument was that there's this thing that the economists talk about is the lump of labor, this belief that the pie stays the same. And in fact the pie continues to grow. The GDP tends to double, and the nature of the workforce changes. You know, we've gone from the beginning of the last century, if you want to be really secular, more than half of the population was engaged in agriculture. And now less than 2% of the population is engaged in agriculture and yet more than 140 million people are working in the economy now, more than ever in history, and so then people come back to me and say, "Ah yes but workforce participation has declined," and I go, "Yes that's true." It's historically low and it might be for reasons to do with the recession, but in fact when you start to pick that apart, there are lots of reasons that workforce participation has declined and probably the aging of the baby boomers is the biggest explanation; not technology. You and I just didn't get the memo about retiring. [Laughter.] But our colleagues did, you know, and they've started to retire and they are not in the workforce. But there is tremendous under-employment; we're in a gig economy, people move from job to job, so in response in particular to your point about aid and support, I'm mixed on that. I mean, I've read all the literature, I think it would be a very difficult political thing to basically guarantee a basic income in America right now for ideological reasons. There have been some fascinating experiments in India, where they've done that in villages, and instead of creating a lazier population, which is the theory of the Conservatives, right? They've actually empowered people and they've gotten much more entrepreneurial behaviour, which I think is

very exciting. But I actually think that the best way to respond to this new reality – which is sometimes described as "the gig economy –" people don't have a single job for their entire career, but they go through a series of different kinds of jobs, at maybe three or four or five year intervals or quicker, might be to essentially subsidize education; don't support people just to support them but to support people who are willing to be retrained – maybe guarantee an education for anybody who's unemployed and who needs a new skill, and make it possible for the workforce to be more fluid. I mean we've done this experiment on a grand scale with the GI bill in the past, why not basically create raw material for a very dynamic capitalist economy? I think it would make our society more competitive. That's a theory... I don't consider myself a social policy person, I'm more interested in the people who design these systems and their values.

Dr. Dave: Yeah, and one of the things that's coming to my mind is this – and I forget what the term is – but the big discussion going on right now, about the great disparity in the incomes and all the capital getting stuck in the top 1%, so that education is not happening in the way that it needs to be happening.

Markoff: Yeah sorting that out is really interesting. My friend Jerry Kaplan argues that this rising scope of inequality in society is an artifact of technology, and I think there probably is a technological component but I think tax policy probably pays a large part too, and once again I don't know if you can blame computerization for rising inequality completely.

Dr. Dave: Well it goes back to, "We've seen the enemy and the enemy is us," and the way that we have structured things. You know, one of the interesting optimistic views is Ray Kurzweil's theory of singularity – I don't know if everybody in my audience has heard about that so... maybe take us through that scenario.

Markoff: Sure. So singularity is a term that was first I think coined by John Von Neumann, in the 1950s, the mathematician, but it was popularized in the 1990s by a computer scientist and a science fiction writer, Vernor Vinge, who is one of my favourite science fiction writers, and he made the observation that because of the accelerating speed of computing, that computers would surpass human intelligence – I think he picked 2023. I think Kurzweil says maybe 2040 or something like that – there's a range of times. But there's the assumption that machines will become super brilliant, that they'll have super-human intelligence and there of course is the corresponding fear that when they're smarter than us for some reason, they'll decide to destroy us, which is an interesting hypothesis, and not clear to me why that would happen. I think you mentioned *Her* at the beginning of our conversation, and I think in the movie *Her* they just get bored with this and they go off to do something more interesting, and that seems like a probably more likely outcome to me. But I have a lot of difficulty accepting – I'm a devotee to science fiction, I love reading that stuff, but I see no evidence that we're approaching machines that are self-aware or super intelligent. I have a piece in the paper today that describes some of the progress that's been made in developing AI programs that can take tests at a human level. And they've succeeded in building a program that will take an SAT test – the geometry subsett of the SAT test – and get about the average level of an 11th grader at this point. But they still have problems with very basic things, like trying to understand what an arrow is, and a diagram is in a test in context – not a solve problem for computers. And I don't see the rapid progress that Kurzweil assumes will happen – I don't see any evidence for that. And I see big, big problems in

that path to super intelligent machines. Herbert Dreyfus is a University of California Berkeley Philosopher, who in the 1960s looked at these attempts by the AI field to make progress toward thinking machines and he said, "You know, describing and writing these programs as working toward artificial intelligent machines is a little bit like climbing to the top of a tree and asserting that you're making steady progress on the way to the moon." There's an interesting parallel.

[Laughter]

Dr. Dave: That's a good one! Let's talk about conversational systems. That's particularly intriguing to me, what with the movie *Her* and my relationship with Siri... I feel like I could almost go there.

Markoff: Yeah that's actually, of all the things that I've written about and explored as a reporter, that's one of the most intriguing things to me, because I do see the progress there. You know, over the 35 years that I've been reporting, I've watched voice recognition, speech recognition, natural language understanding... I've watched great progress, and now we're to the point where you can begin to converse with the machine. I wouldn't say it's a human-like experience yet, but you know, we don't have a machine that will pass the Turing test, but there are machines with which you could have a commercial conversation about making a purchase or doing something else. And I'd read about this after the book, about a month ago, in the science section of the *Times*, I wrote about a Microsoft experiment in China called Xiaoice. It translates to "Little Bing," and it is a chat bot that's intended to be a conversational system. Not to be like Siri; Siri is a program that is intentionally designed not to have long conversations with you, but rather to be a productivity tool: you ask it a question, it does something for you or it tries to answer the question and you move on with your day. Xiaoice in contrast –

Dr. Dave: You're saying "it." I say "she!" [Laughs.]

Markoff: That's interesting. I have a woman's voice in my Siri and I thought about changing it the other day to the Australian or the English version, because I was looking for something that was a little more upscale. But Xiaoice is fascinating because there are 20 million users; 10 million of them are intense users, meaning they have multiple conversations that have multiple components every day. And 25% of the Xiaoice users have typed "I love you" to Xiaoice, 50% have typed "Thank you," and that to me is something that Sherry Turkle, who's a psychologist at MIT, worries about a tremendous amount. She thinks there's something deeply empty about having a conversation with a machine. And I guess I don't think about it in an emotional setting – I mean that's what she's thinking about , is people replacing human friendships with machine friendships and how lonely a world that would be. And it's funny, the scenario I think about is this scenario in Knowledge Navigator, the Apple vision video from 30 years ago, in which an absent-minded professor had this office assistant that helped with his daily tasks. And I can see that being both useful and actually possible.

Dr. Dave: Yeah I must have missed that video because that doesn't ring a bell.

Markoff: I'll send you a link.

Dr. Dave: OK. You know, and I mentioned for the newsletter I put out, I had been writing about *Her* and these other artificial intelligence-related films, and one of the conclusions that I came to

was – that I thought was pretty outrageous, but I put it out there anyway -- was to say that I think that at some level, we want our machines to love us. And as I was going through your book I actually found things that seemed to support that and it sounds like Shirley Turkle is also... I wasn't concerned about it, I was just noting it, but it sounds like she not only notes it but is concerned about it.

Markoff: I think that's true and I guess I was very influenced by the perspective of Alan Kay, who was the person who designed the first modern personal computer. We had a conversation about conversational systems, and one of the things Kay alerted me to was this passage in something that Hegel wrote called the "master-slave dialectic"; it was in the *Phenomonology of Spirit*, and I remember it vaguely from my days as an undergraduate in Philosophy, but I went back and re-read it and Hegel talks about the effect that the slave has on the master, and argues that the master is dehumanized as much as the slave. And Kay thinks about that in the terms of the relationships we design with these machines. If we're increasingly treating these machines as if they were human, then the nature of the relationship makes a great deal of difference. And that's a design question. And he pointed out to me that we can design these things as slaves, or we can design them as our masters, or ideally we'll design them as partners. And I see Siri as an example of a machine that interacts with you as if she's a partner, in my mind, and that's an example of good design. I could see other approaches as well.

Dr. Dave: Yeah. I imagine somebody will design one of these things that will have a nasty temperament. Once there was a program for the Apple II, and one of my sisters' boyfriends was over, and this program – I don't remember the name of it, but it would hurl insults, and this guy got so engaged with it and he was calling it names [laughs], taking it at a very literal level. Now I'm sure you saw – I don't think you wrote it, but I read a story just a few days ago in the *New York Times* that Barbie wants to know your child –

Markoff: Yes.

Dr. Dave: -- and that Mattel has invested a huge amount of resources and conversational systems with, I think they said 700 lines of code, which doesn't sound like that many...

Markoff: No, it doesn't.

Dr. Dave: Yeah, but – so of course that raises all sorts of psychological questions that people have about, "Jeez, do I want my little child saying 'I love you,'" to her doll?

Markoff: OK, I think that's a really fair question. I look at it from a slightly different point of view. There's research that's been done over the past decade at UCSD about providing robots to toddlers, to really young kids, to basically teach them language skills. And I was very influenced – I have been very influenced by my mother, who's now no longer alive, but she was a special education teacher, and I remember her being in despair because she spent a lot of time in East Palo Alto's school district where there were lots of learning issues. And she felt that one of the great challenges she faced was that by the times kids reached her, when they were six or seven, it was already too late, because they'd had this deprived situation at home where they hadn't picked up the language skills that middle class and upper class kids do. And the thought that you could perhaps give a kid a very inexpensive robot that could be a conversational companion, when the family broke down and wasn't working, and could fill that role, that was a really

intriguing idea to me. I don't know if it's possible, but if the family isn't providing those skills and a machine could, why not?

Dr. Dave: Yeah, I think you made a reference to one that I had not heard of, called Jibo?

Markoff: Jibo, yes.

Dr. Dave: Jibo.com if people want to check that out. And I guess it's a crowd-sourced project that hasn't quite reached completion yet. But it reminds me of the lamp animation that – who is it, the movies that uses that lamp animation that turns its head and jumps around... So it's a robot I would say that sits on your desk and is able to converse with you and turn its head around and look at things and put expressions on its little computerized face. I want one!

Markoff: You know, Amazon has a product called Echo that doesn't serve as a robot but it does serve as a, sort of a Siri on your kitchen counter. And you can order things and you can ask it questions and what-have-you. So that's starting to become technology that's accessible to just about everybody. Apple is probably going to do the most advanced effort to make it possible to converse with your television . You'll have Siri technology with your TV shortly. The Jibo project is interesting. I worry a little bit about the surveillance implications and how they can promise me that Big Brother won't be listening to me. It feels a little bit like *1984* doesn't it?

Dr. Dave: Yeah, good point.

Markoff: How do you trust these systems? And I think that has to be solved yet. And of course there's – it's not Jibo but there's a Japanese robot – I'm blanking on the name at the moment – that is going to be arriving in households and these things have threatened to become commonplace for a while. This is one of those issues that I subscribe to Saffo's point of view: "Never mistake a clear view for a short distance." It's going to take a while for somebody to get it right and for this stuff to be an obvious thing you'd want in your house.

Dr. Dave: Well again, in my favourite science journal, *The New York Times* (along with the *New Yorker*), there was a piece, and I think some videos accompanying it about the robot in Japan – one of the first robots that they had there that was a little bit humanoid, you know, it could roll around and so on, that Sony decided that they weren't making enough money on it, because they'd only sold something like 360 thousand and so that wasn't enough and so they discontinued it and people were so attached to it that there's a whole business around people who can manufacture parts, who can fix them and so on, and adults – not children – were extremely bonded to this...

Markoff: Yeah that's Aibo.

Dr. Dave: Aibo, yeah. And that's a fairly primitive version, right? Of a robot.

Markoff: I agree, and there's some talk about Aibo coming back, Sony is talking about getting back into it.

[laughter]

Dr. Dave: So this may be can segue us into your last chapter of your book, which you titled, "Master, Slaves, or Partners," and you take up the plight of our aging population and the role that robotics might play. So, as somebody who is on the cusp of perhaps experiencing that scenario, take us through it.

Markoff: Yeah, so this is a –

Dr. Dave: I mean me, not you, on the cusp.

Markoff: Yeah [laughs], oh me too, believe me. I'm old enough to retire. So, there's a really lively debate right now about whether it's technically possible to have an elder care robot and whether it is preferable. I don't know if you saw one of my favourite movies, it's called *Robot and Frank*, have you seen that movie?

Dr. Dave: I think I did, but I think it's been some time.

Markoff: So a person with early stage Alzheimer's is given a robot and he's an ex-crook and he uses the robot for all kinds of extracurricular activities... it's a very fun movie. So I think the first thing to say is that if you think about the kinds of applications that an elder care robot might be good for – I mean the general point is to allow people to be independent longer, to not have to go into assisted living facilities; that's the goal. And so there's a whole series of things that a robot might be able to do, ranging from helping people remember day-to-day things, to helping people drive, to helping people pick things up off the floor, to really, I think the end goal is a robot that could be dexterous enough and strong enough to help someone take a shower, you know, a very intimate task, where now you frequently you have a health care professional doing this – usually a low paid one -- and so is that the right thing to do if you could do this? First of all I think we're more than a decade away from that being even remotely possible. That level of robotics is just beyond the reach of the – technically now. Then you get into the question of whether it is sociologically or socially preferable, and you know, there's a really interesting discussion that's going on now, and there are people who argue that this is sort of inhumane, and you think about the possible irony in the title of my book, *All Watched Over By Machines of Loving Grace.* There's kind of a creepy possible scenario though, of people who are no longer in contact with each other, and I actually think that's possible but I don't think that's inevitable. I think you could have a set of technologies that would allow people to keep their independence and will allow people to keep human contact. And why I come down on that side, is I've, you know, now I've been involved in the death of two parents and I'm watching my wife care for her 94-year-old father who has Parkinson's, and if there was as assisted technology that would allow her to be able to be in contact with her dad but not have to be responsible for his care in the way she is, I think it would actually be a really wonderful thing.

Dr. Dave: It's going to be interesting to see how this evolves as our generation, as the baby boomers and younger, move up into this old age scenario, who have grown up with technology, because right now I know people – I actually overheard a conversation recently in a restaurant where the couple behind me were trying to persuade their elder person who was with them, how easy it's going to be if they get an iPad and how they'll be able to have video conversations with each other, and you can see them almost trying to drag this person in with all sorts of trepidation and will they be able to understand it and use it and so on. So it'll be different for those of us who already know how to use iPads and such, whether or not we can stay on that technological

gradient as it continues to get more and more complex, remains to be seen. Do you know anything about that or have any observations about the degree to which people are actually taking advantage of social networking, etc., who are in the category of maybe being in an old age home?

Markoff: My own explorations with my mom were frustrating – she was at that juncture. But I think that's that generational point. I mean I think we're that cutover generation and every generation after us will be totally comfortable, and I also think it's a design question – I actually think that good design will make these things simpler and the that user interface will appear transparent and that is actually where things are headed, you know, that's what they refer to as "ubiquitous computing"; the computer disappears and an everyday device becomes magic. And the more transparent it is to the user, the more magic it is and the better the design is. So I think the thing you're describing is an interim challenge, like, remember how cars were hard to operate? You know, you had to crank start them –

Dr. Dave: Oh yeah, I do remember that.

Markoff: And then they standardized the interface and I think that will happen over the next decade.

Dr. Dave: Uh-huh, yeah that seems like a reasonable extrapolation. At a personal level, what would you have become if you had not been a journalist? Was there another path...?

Markoff: Well you know, my first – in terms of a career, after a while I thought I wanted to be a social scientist. I was in graduate school and backed away from that because it was less – being a sociologist when I got into graduate school and understood what it was as a profession, I didn't want to teach. I was interested in research and I realized that I got to do all the good parts of research about the social impact of technology as a journalist without having to worry about teaching, so I went in that direction. So I think once upon a time, a long, long time ago, I anted to be an astronomer, and calculus sort of foiled that and I realized that that wasn't going to happen. So no, I've wanted to be a journalist from right from the beginning I think.

Dr. Dave: Uh-huh. I never aspired to become a market research consultant. As a little boy, that never occurred to me, but I was admitted to an electrical engineering program and ended up shifting out into creative writing, and what got me into market research was seeing that this big thing was going to happen called "personal computing," and boy, I wanted to find a way to take part, and so it turned out that market research was a way to get a front row seat, much as you did with journalism.

Markoff: That's neat. Yeah, the PC swept up an entire generation.

Dr. Dave: Yeah.

Markoff: We were both part of it.

Dr. Dave: Hey John, I want to thank you so much for your generosity and for being my guest today on Shrink Rap Radio.

Markoff: Thank you for having me, it was fun talking to you.