

## CHRIS ANDERSON INTERVIEW PART THREE

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Hello again, Ars Technica listeners. This is the third and final installment of my three-part conversation with long time Wired magazine editor-in-chief, present-day entrepreneur, and Washington DC punk rock legend Chris Anderson. I do hope you enjoy it. We start in mid-conversation, with Chris talking about emerging field for commercial drones called "reality capture"

### TRANSITION MUSIC

Chris Anderson: Reality capture. So right I know that measuring the world's in abstract good, you manage it. I know there's a bunch of industries that could potentially be measured, we talked about Ag, it also includes things like insurance. There could be the infrastructure inspection, there's also a search and rescue and fire and first responder and there's also construction and another industry I didn't know very much about it at the time.

Rob Reid: Another biggie.

Chris Anderson: Another biggie, Second biggest industry.

Rob Reid: After Ag.

Chris Anderson: And if you're just going to simply industries construction, which is architecture or civil engineering concern, it's the built world that is the second largest industry in terms of dollars, second largest employer and growing very fast also not very digital, probably one of the least digitized. And unlike another big one like healthcare where it's also not very digital but is highly protected by laws and regulations.

Rob Reid: Intensely regulated.

Chris Anderson: Yeah. Construction is actually not that regulated, they do feel the market forces and they do feel the pain but I didn't know that at the time. What I did know is that a good friend of mine, a guy named Carl Bass, the CEO of Autodesk at the time, he and I even noted that he's also a Maker. He's got a fantastic workshop in Berkeley. He lives in Berkeley. We played tennis together and we nerded out on things like CNC machines and he's got the best of the best. If you ever been to like any of the Autodesk, pier nine or the gallery, you've seen the cool stuff they have. So he had the coolest stuff and I got to hang out with him.

Chris Anderson: But the other thing Autodesk does is they're a market leader in construction and so AutoCAD for example, They have 80% market share and Carl and I we're nerding out about the manufacturing side of Autodesk and they also, by the way have the Hollywood side, the Maya. So basically models. This would be some models turned into building some models turned into manufactured parts and some models. turned into Hollywood CG. But they're all models. So Carl and i started by nerding out on the manufacturing side, but one of the three legs of that stool was construction and I learned more and more about construction. Construction is a world that begins digital onscreen and then the cad and then the moment you dig a spade of dirt, it's analog and you can't manage it with the same tools you use to design it.

Rob Reid: I'm sorry, the moment you'd dig a spade of dirt, it's-

Chris Anderson: It's analog.

Rob Reid: It's certainly analog.

Chris Anderson: It's analog.

Rob Reid: Yeah, yeah, yeah.

Chris Anderson: It's paper blueprints, guys with hard hats and vest and so you can't manage it with the same tools you use to design it. And so Carl was talking about this digital analog, digital conversion process by which it starts digital, it then becomes analog once you dig and then you had to re-digitize it. So you could continue managing it with the same tools you used to design.

Rob Reid: You had to re-digital note, how did the re digitization proceed?

Chris Anderson: It didn't, I mean that was the notion, the notion was you had to digitize the physical world, but how?

Rob Reid: Yeah. Yeah.

Chris Anderson: And so in the early days everyone thought it was gonna be laser scanners, you're just going to laser scan, laser scan in particular, but laser scanners, expensive, hard to use, hard to care limited to the ground and indoors, et cetera. And so there's broad theme reality capture. So this notion of digitizing the physical world is what we call reality capture. Just like in Hollywood, you do motion capture. But for the physical world is called reality capture. There's three phases at the beginning of a site and now you're scanning the land, the slope, the soil, the existing stuff that needs to be removed. It's called cut and fill the holes, the sand, everything has to come in. Then so that's the site characterization called a design surface and an engineering service. And that's when you can actually, when you design something on screen you're designing on something that's real, that was scanned, it's accurate.

Rob Reid: So precise knowledge of the topography when you're starting.

Chris Anderson: Yeah, exactly. Then you start building and now you're essentially either monitoring construction. And you're checking for deviations, what's called clashes in the industry. So every day the plan said, trench goes here, pipe goes there, concrete goes there and at the end of every day you find out whether that was that happened or not. And if it didn't, that's a clash.

Rob Reid: And the detail is to my novice brain, the plans are the blueprint of the finished building, but what you're telling me is there are step one, step two, step three plans as well. That say, dig trench number one, connect the whole A.

Chris Anderson: You could imagine all the things that go wrong. There could be the simple thing like, hey, there was a big rock there. So I changed, I made an audible, I changed on the fly. That's one set of plan. Another one is, hey, I was supposed to dig there, but oops, it's off a little bit because I'm eyeballing off some orange pole. Next one could be, hey, I was supposed to dig the trench today, but the trench guy didn't show up so we're going to say that's for tomorrow.

Rob Reid: Got it. So the trench at this moment ain't there.

Chris Anderson: Ain't there.

Rob Reid: And nobody really knows this, but the people who are in the very, very front lines. And so what is the notion then with a drone solution.

Chris Anderson: Lines, and so what is the notion then with the drone solutions? You're taking a constant, dynamic picture. Is it a daily dynamic picture?

Rob Reid: It should be.

Chris Anderson: It should be.

Rob Reid: That's the beauty of zero marginal cost scanning. So robot scanning should have no marginal cost.

Chris Anderson: Yeah, yeah, yeah.

Rob Reid: Which is to say, issues like [inaudible 00:56:19] automatically go up and scan it every day and every hour, et cetera. Then you could monitor progress.

Chris Anderson: Yeah.

Rob Reid: Like what's the actual state?

Chris Anderson: Yep.

Rob Reid: You could monitor clashes, what changed. And then you could make sure those clashes are embedded in this living document. Then you update the model so some of those clashes are like, oopsie, let's go back and fix that. Some of those clashes are like, ooh, sequencing, let's change the orders for tomorrow so that the trench guy doesn't have to show up, because the pipe guy got backwards. But the pipe guys doesn't show up because the trench guy didn't show up.

Rob Reid: Another one might be reasonable change made, but is it going to have consequences downstream for the guys who are going to be pumping the concrete, etc. Let's make sure the model's accurate.

Chris Anderson: Let's make sure we update the next several steps because this person, faced with a difficult situation did the right thing, but we need to make sure that that is updating the living document so that it's known forever...

Rob Reid: Exactly.

Chris Anderson: That that wall was actually 4 feet away from where it was originally intended and everybody who's impacted by that will know when the time comes.

Rob Reid: Exactly. It happens so often that the trench guy, for reasonable reasons dug a trench that has a 45 degree bend and the pipe guy wasn't told and he brought straight pipe.

Chris Anderson: Got it. So instead of having an idealized snapshot of the building before you start building it, which the blueprint might be, this is almost like having a live video feed of it.

Rob Reid: It's a living model.

Chris Anderson: That is essentially what your product is now.

Rob Reid: It is. We contribute to that. We do the inputs, the capture that goes into the reality capture. This notion of, it's called BIM, building information modeling. This notion of a multi-dimensional...so we were just talking about spatial dimensions but that's also things like time and cost dimensions and supply chains.

Chris Anderson: So you are the sensors in the sky that are basically the live video camera on the construction site...

Rob Reid: Not video, stills, actually, yeah.

Chris Anderson: I'm using it euphemistically. Essentially the live image, live in quotes. You're the ones who are updating this visual, so if you're short 20 tons of concrete you'll know that.

Rob Reid: It's actually not, well it is visual, but what we do is we turn those photos through a process called photogrammetry, you turn them into 3D models and point clouds, etc. So it all looks like a CAD file when you're done. It's a neat technique, photogrammetry, it's basically when you look at a feature from different angles, because of the parallax effect if I'm shooting this coconut water bottle from one side to the other side the same feature will have different foregrounds and backgrounds because I moved the camera. When you just use the parallax effect you can extract the geometries by just looking at the difference in foreground and background. So photogrammetry turns visual images into polygons and point clouds.

Chris Anderson: So the stills that you're able to take basically results in a robust 3D model that a site manager, a project manager can look at and find out if this thing is actually on target or 8 months late and 40% over budget.

Rob Reid: Yeah, there's loads of different kinds of...sometimes they want to see it in 2D, sometimes they want to see contours, sometimes they want to see elevation maps, sometimes they want to see 3D models. There's a bunch of different things, but the point is that just putting a camera in the sky can largely achieve all of those.

Chris Anderson: Now one of the things you had said is robotic sensors are free. At this point, isn't there an enormous amount of regulatory control over the drone market that basically says even if it could be autonomous and robotic, it doesn't get to be because there has to be a human pilot. And not only does there have to be a human pilot, but they need to be in a line of sight. How is that impacting your and other industries right now? Does it feel you as an intensely sophisticated observer of this industry, like an unbelievably archaic thing like pilot as performance art? Or is it something that's a really reasonable regulatory step to take, less people have drones landing on their faces or something?

Rob Reid: Yeah, it's more the latter. More the reasonable. A year ago, it was illegal to fly drones commercially.

Chris Anderson: I know, which is fascinating.

Rob Reid: Weirdly, as a child can get a drone under their Christmas tree and fly it anytime they want, under what's called the Recreational Use Exemption. But if a trained professional wants to use that same drone to make money, that was, at the time, it required a pilot's license and an impossible permissioning process.

Chris Anderson: So a kid could launch a very powerful drone, a wedding photographer launching a less powerful drone would be in violation of the law.

Rob Reid: Correct.

Chris Anderson: Got it. And that was only a year ago [crosstalk 01:00:50]

Rob Reid: That was until August of last year.

Chris Anderson: What was the logic of that?

Rob Reid: You regulate who you can regulate.

Chris Anderson: Got it.

Rob Reid: You can't send a C&D to a kid.

Chris Anderson: Yeah.

Rob Reid: C&D cease and desist.

Chris Anderson: Exactly. You regulate the entities that have the legal requirement to obey regulation.

Rob Reid: And the point of that was, given that we presumably had lots of kids, un-C&D-able kid out there flying stuff?

Chris Anderson: The point was they never anticipated that kids would be flying drones. Drones are military devices, it was just never considered. It was like a loophole.

Rob Reid: Do you think that the fact that there was a...so drones, you started DIY drones in 2007. Lots of excited grown ups doing stuff. Now if we go into the computing industry and say, what was the equivalent of 2007, it would probably be Steve Jobs and Steve Wozniak around what, 1976, something like that? 10 years after that, well it was 9 years before they lifted that commercial restriction, so the equivalent would be 1985 in computing. In 1985, there was so much commercial computing going on in so many businesses big and small. Financial service industry, hair salons and the whole nine, there was so much commercial activity going on. Do you think it's possible that the fact that the government said, 'For 9 years in your industry, thou shalt not use this commercially' in some ways stifled the industry in a way that made DJI's success inevitable? Because there was no economic activity was allowed in a domain that was very robust, that lots and lots of grown ups, many of them no doubt entrepreneurial, were doing all kinds of cool things with their soldering irons and your plans in 2007. It sounds like it was not until 2016 before somebody said you can use it as a wedding photographer.

Chris Anderson: Counselor, you're leading the witness.

Rob Reid: Well no, [crosstalk 01:02:44]

Chris Anderson: You would expect me to agree...

Rob Reid: No, I'm genuinely asking.

Chris Anderson: No, so it would be very easy to blame the regulators. Actually I think the regulators have...for a while they were not moving at all. Because we use this, I'm going to say loophole, but basically because they had regulations and not anticipated DIY and drones going together. We put a million drones in the air, in the hands of children and amateurs, etc. And those drones were not going back into the box.

Rob Reid: Right.

Chris Anderson: So the regulators were forced to bring them into the fold. They couldn't say no anymore, so they had to say 'yes, but'. And that 'yes but' included taking away the requirement for example, to have a pilot's license when you're flying commercially. So now there's something that's basically a driver's license. It's called part 107. I think that was faster than most people had expected. That happened last year and you could argue, 'well that should have happened 12 years earlier' but the reality is that if you ask why is the sky not dark with drones today, I don't think that regulation is the main answer. I think the main answer is the utility of these things is not well demonstrated. If it was clear to everybody that a dollar invested in drones is 10 dollars in return, I think the sky would be dark. They'd find a way.

Rob Reid: Or a buck twenty. It doesn't have to be as extreme as that.

Chris Anderson: This is always the case. It was true with the early days of the internet, computing before the spreadsheet was little bit of a gimmick. So that year '85 you described, that was...when did Lotus, when did the first [crosstalk 01:04:19].

Rob Reid: VisiCalc would have been the first one, well VisiCalc was Apple 2.

Chris Anderson: A little bit earlier.

Rob Reid: [crosstalk 01:04:26] Sure but that killer app would not have arisen if the Federal Communications Commission or somebody, the FDA equivalent, said 'okay we're a little bit sketchy about these computers because they've been used in a lot of James Bond movies, and governments like to use them, and this is really the domain of the government and the military. So okay, we can't stop these kids from using computers but no commercial software, alright?' So ergo no VisiCalc in 1978.

Chris Anderson: Well member the internet? When was commercial use of the internet allowed?

Rob Reid: The very first..I don't know if it was ever disallowed, but the first ads were sold on the internet by GNN by Jim O'Reilly.

Chris Anderson: No.

Rob Reid: Well the first ads, so he said yesterday.

Chris Anderson: Well ask Lewis and Jane. They'll claim the first ads were sold by Wired.

Rob Reid: Oh no, they'll claim the first banner ads and they'll be right. But the first advertising was GNN.

Chris Anderson: Fair enough.

Rob Reid: Because hotwired was launched in 1984.

Chris Anderson: But you're thinking about the web. Remember the internet, the notion of dotcom, the notion of commercial use of the internet, that was '95? Literally were not allowed, like was against the law to use the internet for commercial purposes before then. Would my life be easier if there were no regulations whatsoever on commercial use of drones? In a little bit, yes. But remember, what I call 'mass jackassery', I'm kind of glad people are thoughtful about the use of drones. I'm kind of glad we're not causing public scares about privacy.

Rob Reid: Well paparazzi and stuff like that, yeah.

Chris Anderson: We've seen what happens. A drone just hit a Blackhawk yesterday.

Rob Reid: Oh really?

Chris Anderson: The last thing we need right now is for this whole thing to get shut down because...

Rob Reid: A Hindenburg moment of some kind. [crosstalk 01:06:14]

Chris Anderson: I can live, I think we have so much work to be done on the return on investment, on the killer app side that I don't feel particularly inhibited by the regulatory side.

Rob Reid: That's interesting. You are one who in some ways has a fairly libertarian perspective and you have a level of sophistication about this market that is, at minimum, 2 orders of magnitude beyond my own. So the fact that you are not feeling alarm, or concern or dismay about this regulatory situation is, frankly, good enough for me. I know how deep you are into this realm and I know that you're not instinctively a lover of regulation against non-regulation.

Chris Anderson: And remember it's a big world out there and if I don't like the regulations here, there's Canada. There's Australia. Drone delivery, the Amazon concept is not happening here for regulations, at least not now. You go to Rwanda, there it is.

Rob Reid: Zipline is an amazing thing because basically what they've done is they've taken fixed wing drones, which are more efficient in terms of their energy usage



rather than quadcopters. I guess they've started using drones to deliver blood to remote places and they're going to be moving up to vaccines and other things that are highly perishable and can't go on long journeys through forest roads. What Zipline does in Rwanda, you're saying really could not be done from a regulatory standpoint, would not be permitted here in the United States right now.

Rob Reid: Let's talk briefly about the future. What drones are going to do, what they're not going to do. People, you mentioned the Amazon home delivery thing, you are a skeptic about that?

Chris Anderson: I am but not because I don't have any lack of confidence in Amazon. I just think that you can buy, I mean this is a really hard technical and regulatory problem. That particular vision, by the way, Amazon buying Whole Foods?

Rob Reid: Yeah.

Chris Anderson: Warehouse to the roof of Whole Foods via drone, sign me up.

Rob Reid: Oh yeah.

Chris Anderson: Drone zones, drop off zones, I totally get that.

Rob Reid: But you still have to go to Whole Food to pick that stuff up.

Chris Anderson: Yeah, you have to go to Whole Foods. Amazon Whole Foods to my backyard with the dog and the kids and the clotheslines, that's, I just can't wrap my head around that.

Rob Reid: Yeah, not even if they're lowering it on a cable from 200 feet or something. It would have to be a windless day or...

Chris Anderson: I don't know, maybe. It can be done. I know that, just when I look at the economics, when I look at the other ways to deliver packages to my home which seem to work pretty well.

Rob Reid: The taco copter is not something you expect to be ubiquitous.

Chris Anderson: Plus, San Francisco banned pot delivery by drone so there goes your killer app.

Rob Reid: There goes your killer app. That was very high dollar value per ounce of shipped product.

Rob Reid: What about the sidewalk drone? I've been seeing [inaudible 01:08:59], well cars of course I want to talk about that is a second. But there was one product out there, and I forget the name of the company behind it, that sort of does that last

mile thing by ambling down the sidewalk because self driving cars are going to be a regulatory issue, maybe self driving, maybe little R2-D2's.

Chris Anderson: I thought that drones with their noise were the most annoying thing you could have in an urban environment. But it turns out I was wrong. Sidewalk robots trigger, even the most capitalist libertarian folks get all class warfare-y when they see a robot trundling down to deliver somebody a burrito.

Rob Reid: Is that right?

Chris Anderson: They just want to abuse those things. Because it's our sidewalk, get off my sidewalk.

Rob Reid: Because it's vandalism. Or dismay.

Chris Anderson: People hate tech pros on sidewalks, even if they're robotic.

Rob Reid: Got it, got it. Do you see anything, even some of the most amazing demos that I've seen of drones recently, you know in videos online and so forth are what swarms can do. Particularly what swarms can do with visual, pyrotechnics, but also what swarms can do in terms of being self organizing and accomplishing lots of teeny tiny tasks as a group. Do you see anything in the intermediate term using swarms of perhaps micro miniature drones to do things that one might not imagine a drone doing today?

Chris Anderson: This is where I'm going to lose any friends I've made on this thing. Every grad student I've ever interviewed for a job here has always studied swarms. With the exception of Intel's very pretty fireworks displays I have yet to find an actual application. Every grad student loves swarms because they're such a cool math problem. No actual problems I could think of, with the possible exception of some crazy military thing I don't know anything about. It's gotten to the point where if someone actually has done swarming in their grad student research they just get eliminated on the sheer... Because first of all it's such a cliché at this point, second of all it's intellectual pursuits without any recognition of marketplace needs. Second of all there really are no marketplace needs, I really can't think of anything. Look, I can articulate the case for swarms as well as anybody. It's parallel processing, distributed coordination, et cetera. I have yet to encounter a problem out there that actually suits a swarm.

Rob Reid: Apart from looking kind of cool...

Chris Anderson: The fireworks [crosstalk 01:11:26] Aside from entertainment, I cannot find...I've been at this a time and I've done my share of swarming and on the roof out there we've done our share of swarming, so technically done, achievable. No one has ever asked me. No customer has ever asked me for a swarm or at least been willing to pay for one.

Rob Reid: Got it. And what about extreme miniaturization being another thing that is always thrilling when one...there was a Ted talk not long ago that the Hummingbird, and I'll say a hummingbird that sounds about as loud as a tractor [crosstalk 01:11:56]

Chris Anderson: Do you know how many of those were made? Well first of all do you know how much they cost?

Rob Reid: Well because they're military I'm sure that they call a staggering sum.

Chris Anderson: I think it was 1.5 million dollars for one. And they never made another one. And they never will make another one.

Rob Reid: Because it sounds like a tractor mower?

Chris Anderson: It's the most exquisite, beautifully designed Swiss watch. With miniaturization you're up against physics. So physics just doesn't scale down. Once you get to little small stuff, the wind turbulence becomes a bigger issue compared to the overall surface area of the surfaces. A bird can turn a worm into a day's worth of flight which is really more about digestion than anything else. Until we can figure out how to do that we got serious power problems. You know what that hummingbird's flight time was?

Rob Reid: No.

Chris Anderson: I think it was 180 seconds.

Rob Reid: That's not long.

Chris Anderson: No.

Rob Reid: You can't get a whole lot done.

Rob Reid: And so are there new markets or new applications that you can imagine when the cost of a real multiplicity of sensors in the sky, being defacto or for all intents and purposes free. Things that we couldn't really conceive of now that might come into sharper focus in the [crosstalk 01:13:05] time frame?

Chris Anderson: Well we're starting to see a little bit of a proxy for this with micro sets or cube sets et cetera. With companies like [inaudible 01:13:12] sending up these constellations of what they call doves. So there used to be that cameras in space were crazy expensive and only for the few, and now they're getting cheap and for the many.

Rob Reid: Yeah, planets put up, what 1000 satellites or something crazy?

Chris Anderson: Remember these things are, because they're in low earth orbit they fall out of orbit. So it's not like you're replenishing constellations. I can't remember what the replenishment cycle is. Let's imagine there's a lot. And there's a lot more coming and with SpaceX getting them to space and the actual cost of them and the satellites themselves it's approaching zero. But clouds, the optics and all that kind of stuff, you still don't have ubiquitous eyes in the sky. 80% of the planet's covered by clouds.

Rob Reid: 80% at any given moment.

Chris Anderson: Any given moment, yeah. So you don't have ubiquitous eyes in the sky. Meanwhile you have sensors on the ground, streets and cars and things like that. But also not ubiquitous coverage. So there's clearly an opportunity for certain areas to get ubiquitous coverage below the clouds but above the ground. And that's the opportunity for drones. It's not everywhere, I hope it's not over our cities, that would be creepy. But it could certainly be over security, over campuses, certainly over construction sites. I haven't given up on ag. I personally as a company have given up on ag, but as a person I still think that the notion of drones over farms is going to be certainly more common than crop dusters over farms.

Rob Reid: Yeah, that just seems logical.

Chris Anderson: And why not? Well I guess we just talked about why not. But someday.

Rob Reid: Well you've been wildly generous with your time, Chris.

Chris Anderson: Thank you, this is always fun.

Rob Reid: I appreciate it immensely and once we get off mike, you will sign this album for me.

Chris Anderson: I will, but what should I sign it?

Rob Reid: I don't know, that's your job. I'm handed books a lot now that I got a new book out, and I'm always stymied but I always come up with something.

Chris Anderson: We outlasted R.E.M.

Rob Reid: Thank you so much.

Chris Anderson: Thank you.

Rob Reid: So thank you for listening to my conversation with Chris Anderson. As you can probably tell I had a huge amount of fun with him. My sole disappointment is I was hoping for a bit more starry eyes speculative Wired-like prognostication about some way cool next generation uses for drones when I brought up the

subjects of drone swarms, ultra miniaturization and couple other things towards the end. But one of the many things why Chris was a great editor of that magazine is that he is, at bottom, a realist. He only goes on those sorts of riffs when he truly believes in them. And in this case he knows the subject cold and just doesn't buy into the notion of taco copters delivering food to our backyards or thousands of microdrones living in hives.

Rob Reid: One thing that's evident from this interview is Chris's enormous generosity of spirit in talking about people who've really messed with his business. First his Chinese competitor, DJI. As you heard, he is very impressed with that company and goes out of his way to praise them as an innovator and not just a copier as some might allege. And basically says, they won fair and square. Very few other CEO's that I've known, probably as few as zero, would be this charitable about a competitor that waged a scorched earth campaign which successfully terminated that CEO's principal line of business. But from all I've heard about DJI, Chris is not just generous but correct in his assessment because it is, by all accounts, a truly amazing and innovative company.

Rob Reid: Where I diverge with Chris, after listening to this interview 3 or 4 times after the fact, is on his generosity towards the regulators who forbade the use of drones for commercial purposes for almost a decade in the US. Chris said if you ask why the sky is not dark with drones (a great phrase by the way) regulation is not the main reason, but rather it's the lack of killer apps. And if you don't know that term, it originated in the PC era to describe applications that made PC's an essential item for significant markets of people and companies. In the interview, Chris and I specifically talked about the spreadsheet in this context. The thing is, markets don't generally produce killer apps when it's illegal to sell them. A great application of technology, whether it's a world class spreadsheet or an automated drone-based crop dusting solution takes teams of expensive people and significant time to build. And companies just won't invest the necessary capital if they know that once they're done, they can face a 5 year wait for some bureaucrat to grant them permission to be in business. I conceded the point in my interview with Chris, deferring to his immense expertise in this field. And it's a bit unfair for me to take that concession back now, when I'm the only one holding a microphone here. But on reflection, I just can't ignore the circularity of commercial drones not becoming a big deal for a lack of killer apps during a decade when the development of such applications would have been, for all intents and purposes, illegal.

Rob Reid: More than most fields, drones drew hordes of passionate makers and tinkerers. These people are often quite highly entrepreneurial by nature and that vast, tightly coupled and wildly enthusiastic community could have unleashed all kinds of early commercial products. And a few of them might have created an entirely new markets that we can't imagine, simply because they haven't been created yet. Those markets might have been vital lifelines at 3DR as the consumer market shriveled under DJI's attack, leaving only the commercial market. Now we can't rerun history, so who knows? But this really seems like a

case in which US regulators strangled a market which was born largely of American innovation to the great benefit of China.

Rob Reid:

Now, I don't fault Chris's judgment in this at all. And I'll again concede that he knows far more about this stuff than I do. But he's also in the top percentile when it comes to generosity of spirit, as I just mentioned. And that very admirable quality may be doing some of the talking here.

And Ars Technica listeners - concludes the final installment of my interview with Chris Anderson. In case you're interested, the current episode of my podcast is an interview with Yale University primatologist and psychology professor, Laurie Santos. Laurie has done amazing research on cognition in animals including monkeys and dogs. We talk about all of that.

Then we discuss the darnedest thing - which happened earlier this year. Sensing that there was something of a misery epidemic underway at Yale - something which is also quite well-documented on campuses throughout the US as well - Laurie decided to launch a class on the science AND practice of happiness. To her astonishment, it quickly became the most popular class in Yale's 317 history. A QUARTER of the University took the 1.0 version of her class this spring. We discuss all this - as well as neuroscientifically proven ways that you too could become a happier person in the podcast's current episode.

You can find it by visiting my site, at [after-on.com](http://after-on.com). Or, just type the words after-on into your favorite podcast player, and scroll through the episodes. There, you'll also find lots of stuff about life sciences - above all, genomics and synthetic biology. Conversations about robotics, privacy and government hacking, cryptocurrency, astrophysics, astroarchaeology, and a whole lot more.

Or, you could just join me next week, here on Ars.

**OUTRO MUSIC**