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Dan Shapiro helps us explore some inventions and innovations this week that offer a surprisingly valuable experience for their price. If you're looking for luxury on a shoestring, you won't be disappointed by Dan's picks.

Mark: Welcome to the Cool Tools Show. I'm Mark Frauenfelder, editor in chief of Cool Tools, a website of tool recommendations written by our readers. You can find us at cool DASH tools DOT org. I'm usually joined by my co-host Kevin Kelly, but he is off this week.

In each episode of the Cool Tools Show, Kevin and I talk to a guest about some of his or her favorite uncommon and uncommonly good tools they think others should know about.

Our guest this week is Dan Shapiro. Dan's a serial entrepreneur, he founded Photobucket and most recently Sparkbuy, which was acquired by Google. Last summer Dan invented a board game that teaches programming to preschoolers called "Robot Turtles." It became the most-backed game in Kickstarter history and is available now in Target stores nationwide. Dan's now working on a book for O'Reilly about startup CEOs and enjoying the end of the summer with his wife and five year old twins.

Hey Dan, how's it going?

Dan: Hey Mark!

It's fantastic!

Mark: Good, good! So we had you on Gweek a few weeks ago and you shared some cool stuff with us, but you are like a deep fount of cool stuff so I'm so glad that you could be here.

Dan: Thank you!

My combined Amazon and Aliexpress and other shipping bills sometimes pay the price for that but I can never resist a good tool. I've been reading Cool Tools for at least ten years, probably longer. I got my dad turned on to it so he'll probably hear this at some point and I'm really excited to be here.

Mark: That's great! Wow! Thanks a lot.

So we've got a long list of amazing stuff to talk about so let's just get started. The first thing on your list is a Brushless DSLR Gimbal and it's a great way to make your videos look good. Tell us about it!

Dan: I've never been much of a videographer but I was shooting a video and I have really shaky hands, like you watch me and my hands just tremble, and in all of the videos you can really see that. What I was basically looking for was a gadget that would help me take better video. So I read a couple of books and I was reading some blog posts and one

thing everybody said was “having really steady camera is important” and I’m thinking “my hands shake all the time.”

So there’s all these rigs to do it like a big heavy camera like what the news crews have that has a counterbalance that you wear around your waist and shoulders and they’re thousands of dollars and they’re hard to use and they’re really complicated. Okay, I didn’t solve the “really complicated” part. In fact, this is really more complicated than anything but it’s so amazing.

Someone came up with this really amazing idea that sounds like it shouldn’t even work which is to put a three axis gyro right underneath the camera and then use motors to cancel out every motion of the camera except the ones that you mean to have happen.

The system is called a BaseCam. It’s the circuit board that does all the hard work, connects to the gyro, runs the motors, has the motor drivers, and then you get this rig with two handles on the sides and an optional one on the top. It’s usually made out of carbon fiber. There’s a ton of them you can get for a couple hundred bucks or fifty for a hole in the gridded system.

It looks ridiculous and you put the DSLR on it and then you plug it in to your laptop and you do this tuning dance and you set all these parameters and then you fire up the video recorder and you start walking around with it and you look at what comes out of it and it looks like you just shot a documentary even though you don’t know what you’re doing.

It’s like sprinkling magic fairy pixie dust on any video you shoot. These things are incredible! I’ve been using this every excuse I have to shoot video now because it’s so amazing. You can get smaller versions for GoPros and bigger versions for fancier cameras. You can get them for the Black Magic which is a dedicated video camera, but I have a cheap low end DSLR that I love and it shoots great video and my five year old daughter who was walking around with it and took incredible video.

It’s kind of foolproof once you’ve got it set up and working. These things are just magic! Technology makes it work better.

Mark: Wow!

I’m looking at the video right now on the link that you provided to an Ebay vendor who is selling it. It looks kind of big, but since it’s made of carbon fiber I’m guessing that it’s not too heavy especially if your five year old daughter is running around with it.

Dan: Yeah it’s kind of large and clumsy and you look ridiculous when you’re using it, but it’s quite lightweight and what’s interesting is the designs all came out of the drone community. So you’ve got people who are doing quad copters and building stabilization systems for them.

And I believe the BaseCam engineer who created the first of these, a Russian guy, was originally designing for drone stabilization systems so you can actually bolt one of these to the bottom of a drone. I have a quad copter, which we might find time to talk about later, that’s got a mini two axis one of these for a GoPro on the bottom.

That's what it was sort of designed as and then people said "wait you can actually use these to shoot video" and so for less than five hundred dollars you can get a rig that works better than a multi-thousand dollar steady cam. It's very light. It's very stiff, but it's kind of big and you look totally ridiculous when you're using it.

Mark: Also I think when you carry around heavy duty looking camera or video equipment people tend to give you more access to things. They tend to think, "Oh this guy's serious. Let's let him to the front of the crowd." I've noticed that.

Dan: Yes, nobody will suspect what a complete incompetent amateur I am when I'm carrying this thing around.

Mark: Do you have any videos that you've shot using this on your YouTube channel so that people can check it out?

Dan: I will throw up a couple. I've got some family videos that I've been shooting with it and just a lot of playing around.

The other thing it that I've been shooting videos with the GoPro on the bottom of the drone and it's uncanny because the drone is flying all over and it's wobbling around in the air and the video off the camera is just dead steady. They're really weird to watch if you've just watched somebody using them because you see them moving around and it looks like a crazy spaceship they're just holding the carbon fiber rig but the camera is just hovering. It just stays still.

Mark: That's so cool.

What you've got next is a book that I've never heard of before form nineteen eighty nine.

Dan: Yeah, it is a crazy text.

I wound up having this as a textbook for when I was taking and electrical engineering course in college and it was already out of date by then. The third edition is now twenty five years old and there are rumors on the internet that a new edition is coming. No maybe it's the second edition. There are rumors of a third edition. The second edition is from '89 and it's by the same original authors Horowitz and Hill, but it's this incredible textbook.

These two professors are Physics professors and as I understand, what happened was they were astonished that their Physics students were so utterly incompetent at building anything. They were frustrated that they just couldn't get them to do even the most basic circuits or instruments or troubleshooting because they just didn't understand anything about electronics. They understood magnetic field theory and Emperor's Mole equation that governs transistor saturation but they couldn't make a timer and they couldn't troubleshoot really basic stuff for their equipment.

So they started off with a stack of, since it was '89, mimeograph notes like with the turn crank, with tips to make your circuits work. And it turned out to be a thousand page book that is the definitive reference on making electronic circuits that work. So it's not

about the theory or the equations. From time to time they say, "Okay we're going to give you the equations but you can skip to the end," because they're physics professors so they've gotta share the math but they're pretty restrained about it.

Let me give you an example. They will show you sample oscilloscope traces and say, "The one on the left is what it should look like. The one on the middle is what happens when you forget to screw your probe in all the way. The one on the right is what happens when the cord for your probe is wrapped around the power cord and you're inductively coupling some of the power into your supply," and you look at this and you're like, "Oh, okay. That is incredibly practical information." It's not theory. It's not highfalutin. It's, "Here's how to go build things that work."

Now some of it is kind of dated. There's a great write up of the Motorola 6800 processor. So you pick and choose judiciously, but of the thousand pages about two thirds of it are absolutely dead center relevant to today and it's still in active use, which brings me to the only shortcoming, which because it's a huge book and it's still in active use as a textbook, it's priced accordingly. I think it's more than a hundred dollars. You want to pick it up used because there's a lot of used copies floating around and it's a fantastic reference for people who want to build circuits that work.

Mark: That's interesting.

Even the cheapest used copies are going for about seventy bucks right now which is a testament to how valuable people think this book is.

Dan: Yeah it's one of the classics and one of the things that's interesting about is because of when it was written and the focus on it it's really an interesting junction between analog and digital. So it's a fantastic book for figuring out things like "How can I run a circuit that runs off of stray currents that I pick up from Wifi." Even though it predates Wifi it will give you what you need to figure it out. There's a section there on transponders which are this incredible technology that not many people know about where you have a little passive antennae.

You pick up radio waves that are coming over the air, store them in a capacitor and use them to run your circuit. And if memory serves the example they give was for tracking moose in the Arctic and they'd fire high power radio signals. The transponder would absorb it, charge up its capacitor, and then reflect back a tiny signal, modulated with a little bit of data on it and this is how they would track moose. And this is the same way that they RFID circuits are working, this transponder technology.

So it really gives you these interesting fundamentals for doing something. It's not "How do you wire up an Arduino?" it's "When you want you Arduino to talk to a motor and you have to figure out what hands on and it's really well written. The notes section on op amp they have things like, "This one's a big brute." "This one's a big high voltage brute." "Don't use this for frequencies above this and that because it has a strange bug." It's just very much written like people are building stuff and want to help you build stuff and that's pretty rare for a textbook.

Mark: That sounds fantastic.

What a cool pick! Thanks Dan!

We've got another fun on that I may have seen at the Engadget Insert Coin competition called Navdy. It's a heads-up car navigation system that you are involved in on some level.

Dan: Yeah, I'm an advisor to the company so I got to play with one early so I got to use it for a while and I am dying to get it back. It's going to be shipping the start of next year. They have a crowd funding campaign up now.

It is so incredibly clever. What they've basically done is they've taken one of those pico projectors, the really small projectors that put a reasonable bright picture on the wall, and they've come up with some incredible optics so that the image appears to be floating way out past the dashboard of your car.

So, I get lost going in a straight line. I am terrible about finding my way around. I'm always using Google Maps to get around. I've got an Android phone but it works with Android or iOS. The problem is that I don't wasn't to be looking around and focusing close and then far away. I've got a mount, but you have to look down to see the mount and then focus to see what's ahead.

What pilots do is they use heads up displays because they can be focusing at a distance out in front of them. The Navdy element lets you do that, so without having to look down or refocus close to you and lose your focus on the road you can see the directions and you can see where you're going. It is magical.

The thing is so bright that in full sunshine in the afternoon in the summer, I had it at forty percent and could see it perfectly clearly. I didn't want to turn it up because it got too bright. This thing is crazy visible in all kinds of weather and connects up to your phone so all the apps you normally use is what it uses to help you around, it's not a proprietary thing. I'm just stoked to get one of these permanently.

Mark: You may have said this, but I missed it.

Does it interface to an iPhone or an Android phone or is it completely standalone? Is it Bluetooth connection to your smartphone?

Dan: Exactly.

Bluetooth connection to your smartphone so it can take the notifications and the mapping functionality out of that. I hate the standalone devices because if I have a calendar request and want to get to that, the last thing I want to do is type that address into another device.

So it has a Bluetooth connection to your phone, either Android or iOS and that's the way that you send it information and that's what does the navigation, the GPS and everything else. And so it's pretty reasonable.

Right now they're selling it for \$299. I think it's going to be \$499 when it's done. To get something comparable with your car would be thousands of dollars if it's even available. I think the Corvette has one that's a multi thousand dollar option. And then at some point in the future you won't be able to upgrade the firmware, swap it out. The Navdy you can just plunk on your dash, and there's one other cool thing about it.

It plugs into the OBD2 port, which is this magical plug on basically every car that nobody knows exists. It's down underneath the steering wheel and not only does it give power, but if the airbag is deployed or if there are problems in the car it can do analytics and diagnostics. It knows when you park. It knows when you're driving.

There's all sorts of features that they're going to be able to build into it because you can actually talk to your car. Personally I'm looking for the navigation but I can see so much stuff coming out of it as the software develops and grows.

Mark: Yeah, what a great idea.

And the heads up display is so important because then your eyes are on the road where they belong.

Dan: Yeah.

Oh and I forgot one other cool thing about it. I've never seen this anywhere. If you get a call and you don't want to take it you give it a thumbs down and it actually has a camera with gesture recognition so if you want the call you give it a thumbs up. If you don't want the call can thumbs down. You don't have to take your eyes off the road. You don't have to deal with, I don't know about you but whenever I try to use voice recognition software it's a mess and the last thing you want to do is accidentally pick up a call you meant not to take. I think it's a genius way to interact with something on your dash.

Mark: Super cool!

So it's called N-A-V-D-Y, Navdy.

This next one is insane! A nineteen dollar quad copter.

Dan: Can you believe this?

I have been playing around with RV aircrafts for years now and they just keep getting cooler and better. Five years ago I got a thirty dollar infrared helicopter. You've probably seen these. Airhogs makes them and they're foam and they're thirty bucks and they've got a rotor and a tail and they're okay, but at the time I thought they were magical and amazing. And then I saw that you could get an actual quad copter with gyroscopic stabilization for a hundred bucks and then they just started getting smaller and cheaper and smaller and cheaper.

And it's no coincidence that this is on the same list as the camera stabilization because the same core fundamental technologies of taking the gyros and accelerometers that were in phones and taking them into this world of real-time stabilization is what's made

this thing possible but I couldn't believe it when I saw that they'd gotten the price down to nineteen dollars.

Nineteen dollars gets you a gyro stabilized quad copter and the transmitter and the battery and the charger and the darned thing flies great. You could fly it around your living room. You could probably fly it around your bathroom although I haven't tried it. Its super stable and small, fits in your pocket easily with room to spare and it's even capable of doing flips. The thing is just remarkable.

Mark: So I am going to buy one immediately.

Dan: It's only nineteen dollars.

Mark: And there's no shipping.

Dan: With free shipping, yes!

Mark: So what I need to know is, I'm right handed so should I get the mode one right hand throttle or mode two left hand throttle.

Dan: Oh, you ask a very good question.

It turns out you can get yourself into a lot of trouble here because if you choose wisely then every quad copter and RC airplane in the world is at your disposal. The reflexes that you learn on this and skills around orientation are directly transferable to thousand dollar plus devices.

If you choose wrong then you will be unlearning habits for the rest of your life. The US uses mode two, other countries use mode one. You want mode two.

Mark: Okay, wow! Thank you.

Dan: Great question!

Mark: This is so cool. They accept Paypal.

I had ordered a quad copter for one of my daughters on Bang Good a couple of years ago and it was like seventy bucks.

Dan: Yeah, this company Bang Good in Hong Kong has been at the forefront of carrying these things at low cost with free shipping. I previously has a thirty five dollar copter for them and I think I can stack four or three of these Cheerson quad copters on them because they're so small now.

They have good service. I've always gotten everything I've ordered form them. It takes a long time, that's the only caveat. Expect to wait one and a half to three weeks. They're also available on Amazon for about five bucks more which sounds like nothing until you realize that's like twenty percent of the cost of the device.

Mark: Yeah, that is so funny. What a great pick.

Dan: And you can even get it in lime green and pink and blue and fun colors. It's comes in a cool box. It's just really amazing.

I'm buying three of them just to have on stack for gifts. Random, "forgot to get someone something" gifts.

I don't remember if I put it on the list but I should probably mention the full sized copter I've been banging around because it's kind of a natural next step. It's called the iFly dash four. I have to caution you because some of the amazing quad copters like the 3D robotics Iris basically fly themselves because they have a GPs onboard. You say, "Go that way" and they go that way and then they just sit there. This is not that. It doesn't have a GPS. It's very stabilized but you're going to have to fly it. It will sort of bob around and you have to steer.

The Cheerson, the nineteen dollar one, is good practice, but this quad copter is just two hundred and twenty dollars and it's fully capable of flying a GoPro and flying and what's called an FPB rig where you can actually have a camera on board that send real-time feedback. It doesn't come with one but you can get that. It's about a foot and a half square so it's a real quad copter. I've been shooting a bunch of aerial video with it. Like I said I attached a GoPro with a Gimbal to it.

Same sort of thing I was talking about before but just a little one with a quad copter. Attach it with zip ties and it works great. I'm taking amazing video footage form it. So when you've mastered the twenty dollar Cheerson you can step up to the two hundred and twenty dollar iFly four.

Mark: That sounds great, cool!

So your next pick is called Aliexpress which is related to Alibaba.

Dan: Yeah, so there's a lot of interesting retailers out of Hong Kong right now but one of my favorites just for sheer amazingness is Aliexpress.

So Alibaba is now a giant multinational publicly traded company that basically connects people with suppliers, mostly in China. That's where they're from and that's their specialty. So on Alibaba, the parent company you say, "I want a thousand quad copters" and people give you quotes and stuff. Aliexpress is their one-off system. So unlike a retailer, you're actually dealing with individual sellers but they're much more likely to be factories that make these things or individual entrepreneurs that buy stuff from the factories and then resell them as opposed to a traditional store.

The variety of stuff on there is amazing and what I love it for is not necessarily for stuff like the quad copters, but for stuff like materials, so if you want magnets of a certain shape and size. I wanted to buy come peel and stick adhesive veneer. So I wanted a nice wood veneer with tape basically permanently attached to the back so I could cut stuff out of my laser cutter and I actually wound up making, as my test project, an Elsa sticker for my daughter.

You can find all of this obscure stuff very inexpensively in ones and twos. When I needed mirrors for my laser cutter I could buy Chinese mirrors from a domestic source for sixty dollars apiece or I could buy them from Aliexpress for six dollars apiece so the value is remarkable so you can buy three or ten or twenty of these things.

They have everything from fashion to electronics to lumber, across the board. It's one of those secrets in my list of suppliers. Everybody knows about Ebay and Amazon. Some people know about these sites like Bang Good and Deal Extreme, which is good for electronics from China, but Aliexpress is underappreciated.

I just have one special hack for my friends who live here in Washington State with me which is for some reason they don't allow you to ship to Washington State. There's something about state laws here which means when you put in Washington state they say, "I'm sorry we can't sell to you" but I will tell you how to get around this. Whenever I order something from Aliexpress I use my address and Zip code and I say I'm in Washington DC and I know any postal carrier will look at that and go, "Oh he put the wrong Washington, I can see that from the Zip code." If you live in Washington State make sure you put Washington DC when you sign up and everything will get to you just fine.

Mark: This is amazing!

I use a lot of USB battery chargers because I have a lot of gadgets. They are dirt cheap! They're so cheap compared to a Mofi or something.

Dan: Yeah. Every size and shape you can imagine, super inexpensive and at that price you can order two or three and see what works.

Because they have ratings like most other sites I've actually had really good success with vendors who really care about it. If there's a problem they seek to make it right so I've had great experiences working with them.

Mark: So Dan this has been so much fun. We are out of time.

We had a couple of other things to talk about, but that's a good excuse to get you back on again because this has been so much fun. You've cost me a lot of money already.

[Laughter]

Dan: That's what we're here for.

Mark: So Dan where do people go to find out about you and Robot Turtles and the other projects you're working on?

Dan: Thanks for asking.

I'm Dan Shapiro DOT com, Dan Shapiro on Twitter and Robot Turtles DOT com for the game.

Mark: That sounds good and if you go to Boing Boing DOT net and click on the podcast link you'll find our hour-long interview with Dan where he talks about all kinds of cool things and also his hit game called Robot Turtles that teaches preschoolers how to program.

Dan, thanks so much!

Dan: Thanks so much for having me, Mark.