



Cool Tools Show Podcast Episode 306: Windell Oskay

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- 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 [cool-tools.org](https://cool-tools.org). I'm joined by my co-host Kevin Kelly, founder of Cool Tools. Hey Kevin.
- Kevin: Hey, it's great to be here.
- Mark: 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.
- Mark: Before we introduce this week's guest, I want to give a shout out to our Patreon supporters. Patreon is a great way to support everything Cool Tools does, including our newsletters, our podcast, video channel, and our review website. I'd like to give a shout out to our sponsors this week, including Bill Schuller, Bob K, Ryan Pelly, Carl D. Patterson, Chad Cosby, and Chris Wheland. To become a patron of Cool Tools visit [patreon.com/cooltools](https://patreon.com/cooltools). Our guest this week is Windell Oskay. Windell is the co-founder of Evil Mad Scientist Laboratories where he designs robots for a living. Hey, Windell, how are you?
- Windell: Great. Thank you for having me back.
- Kevin: We're really, really interested in hearing your new set of stuff for us.
- Windell: It is always hard to pick just four.
- Kevin: It is.
- Mark: I'll bet it is. Yeah. And you've got a lot of things in those Evil Mad Scientist Labs of yours. So why don't you go ahead and start by telling us your first tool?

- Windell: My first tool is a classic six inch ruler made by Mitutoyo. It's a six inch or 15 centimeter ruler. It's just the kind you call a machinist scale, which is to say that it's one that a machinist would use for measuring how far their parts stick out of their vise and their milling machine or things like that. And this is sort of an unremarkable tool. It's just a ruler, but it's also just the nicest one I've ever seen. The nicest one I've ever touched.
- Windell: And it's made by Mitutoyo, who is one of the most respected names in precision measurement tools for mechanical things. And it is made of steel that's thicker than you expect. It's ground flatter and straighter on all the sides than you would expect. You don't expect the edges to be perfectly polished. And it's got this gorgeous satin chrome finish with these engraving marks that are just finer than any of the other rulers that I have. And it's easier to read, and it feels like it should sell for a hundred dollars, especially being by this brand name. But it's only about \$15. And I got this recently and I'm just tickled with it.
- Kevin: I'm looking at a picture of this little six inch ruler. What's interesting is that, whereas you might expect on a tape measurer that the inch would be divided into half inch, quarter inch fractionals, it's divided into decimals.
- Windell: That's right. The inch side of the ruler has divisions into tenths of inches, which are very easy to read quickly and also hundredths of an inches. And you can literally read this thing down to decimal hundredth of an inch quite easily. I do a lot of CNC machining as one of the hats I wear as a machinist sometimes. And I had a really hard decision when I was setting up this machine initially, whether I should set it up in inches or in millimeters, because I had come from a physics background and I think in metric, but yet I'm very calibrated to using inches for things. And I'm very aware that our set of tools most easily available in the United States is all inch based. So I use decimal inches for almost everything mechanical that I actually build. All the parts are designed in millimeters and then manufactured in inches.
- Kevin: When machinists talk about thousandths, you know, five thou, I got to move this five thou. They're talking about thousandths of an inch or thousandths of a meter?
- Windell: So usually it's the term thou or mills in a machining context both mean  $1/1000$ th of an inch, which is just over the thickness of a sheet of notebook paper. Or I should say five is just over a sheet of notebook paper thickness.
- Kevin: And your ruler would have little markings for those thousandths?
- Windell: It has measures at  $10000$ ths because it measures in hundredths of an inch. So I could stack three pieces of paper and that would be about the finest division on the scale.
- Mark: Back in my engineering days in the disc drive manufacturing world, a  $10$ th was a  $1/10000$ th of an inch. And in the machine shop, the machinists there said that it was like impossible to get anything to a tolerance of a  $10000$ th of an inch. And once in a while, an engineer would come in with a prototype and ask him to like shave off a  $10000$ th of

an inch. And the machine just told me he would just set the part down on the desk for about an hour or so, and then call the guy and say, "Okay, I did it." The guy would pull out his calipers and say, "Perfect."

Windell: It's really hard to measure in 10000ths. We do actually have one part that we manufacture here that I'm sensitive to the 10000th. And I adjust the diameter of one particular hole that needs to be super precise by 1/10000th in diameter, gradually as our N-mill wears down.

Kevin: Okay.

Windell: And, weirdly enough, that's actually a plastic part. We're actually machining plastic to that precision, which isn't really obvious that you should have to, or be able to.

Kevin: I would imagine though that plastic might be more thermally stable to that level than even steel or metal, which would be expanding and contracting because of the temperature.

Windell: Well there's as much, and probably more, variation in what plastics really are versus metals that there's such wildly different materials that we all call plastic that all have their own beautiful little properties.

Kevin: So that's a great handy little lifetime tool. Tell us about another one.

Windell: My next tool is also from the machinist world. It is catalog. It is from a company called Mitee-Bite, M-I-T-E-E dash B-I-T-E, that makes specialized tools for machinists to mount things in their mills and lathes. There's sort of a saying in machining parts that if you can hold it, you can cut it. Because we have really hard cutting tools. You can get diamond tipped tools if you want to, or even solid diamond tools sometimes, but how to mount a thing so that you can hold securely while you cut it is a really big, difficult problem because you may have a thing that is delicate and will crush if you grab it too hard. Or you may have a thing that doesn't have any square sides to grab upon. If you need to mount a sphere just right and cut at the right place on it, that can be really hard.

Windell: So this catalog is a 50 page-long catalog that has a number of different families of specialized tools that this company manufactures that are all different ways for machinists to mount things. For example, there's regular vises that will grab a thing from the outside. There are little expansion clamps that grab a part from the inside. So you might have a hole in the center of a part and you can put this over one of their specialized clamps, you turn a screw. And then that little part inside expands to fit the inside of your hole. So now you can grab the whole thing by a hole on the inside.

Mark: Comes in handy when you need that.

Windell: Yeah. And what I've found is that this catalog has become one of my key reference books when I am designing physical setups and I'm trying to figure out how to hold a thing, how to mount a thing.

Windell: And increasingly I found that it's just sort of a general reference for me as a reminder of what different types of good mechanical design look like when you need to know how to mount something securely. This is a wide ranging problem when you design mechanical parts. And you might look at 507 mechanical movements when you want to find out how something needs to move, but when you want to find out how something needs to stay put, you need to think about what kinds of forces you can apply in different contexts. So I found this catalog to be more useful as a tool on its own than necessarily any one thing inside of it.

Mark: Interesting. So you're just like studying the mechanisms and the linkages and stuff like that?

Windell: Essentially. Yes.

Kevin: Yeah, yeah. This is the catalog of possibilities, because maybe even if you don't order one of them, you may have an idea about how to reconfigure something you already have that might do something similar.

Windell: Absolutely. And I've used parts from this catalog many times and I've adapted parts from this catalog to be used how they didn't intend it as well. You can go to their website and download this as a free PDF. And it's a neat reference to have.

Kevin: Yeah. If you've ever tried to drill like a sphere or even a rounded part, it is so hard if it's off the actual direct axis. So I sympathize.

Mark: Windell, have you ever seen that book from, I don't know, it was probably like from the '30s or something called Ingenious Mechanisms and it was a four volume set? I think it was called Ingenious Mechanisms for Designers and Engineers or something like that.

Windell: I actually don't think I've seen that one.

Kevin: Yes. There's a one volume version I think that Dover puts out, but there was a larger set of all the known mechanical devices, I guess, you know, like from pulleys to levers to odd [crosstalk 00:10:25].

Mark: Converting rotary motion into linear motion. That kind of thing.

Windell: One of the books that I do have and use as a regular reference is 507 Mechanical Movements by Henry T. Brown. I have an inexpensive copy that I got from Ada's Technical Bookstore that I use as a regular reference. And it is one of these books that frequently lives on my desk, especially when I'm designing new mechanisms and I need to think of different linkages and things. But this is a compact, single volume master work on levers and pulleys and linkages and a whole lot of ingenious things that we just don't normally think of.

Kevin: Yeah. I think we're thinking of very similar things. I think there might have been a multi volume version of that at one point.

Mark: So that sounds good. That's another good tool to add to the list.

Kevin: Yes it is. And, again, it's like one of those things where even if the particular device or mechanism that you were thinking of isn't there, something else nearby might prompt the solution to you. It's well worth paging through and browsing kind of no matter what you do.

Mark: Yeah.

Windell: It is. And yet I've actually found it, when I'm stumped on a mechanical design, I've actually found it to be really inspiring just to think of some things that weren't on my horizon. Even though I've used this book for years and there's only 500 subjects, I still keep discovering things.

Kevin: There actually is an online version of that book where the mechanics are actually animated.

Mark: That sounds great.

Kevin: Yeah. That is really, really useful because you can see them in action. Sometimes it's kind of hard to see how the things actually work just by seeing a line diagram, a still one. But there's animated versions. Not all 500 are animated, but a lot of them are.

Windell: In addition to that, there is a person who has been 3D printing many of the models. And we should get a link to that website, both of the animated one and the 3D printed models in your links because those are delightful.

Kevin: Yeah.

Mark: That sounds really good. So Windell, what's the next tool?

Windell: My next one is what is sold as universal dust cleaner. It is a gel and it is a thing that is sold on Amazon and other sites as a IT department kind of cleaner. They show pictures of it cleaning things like keyboards and sometimes car interiors. And what it acts actually is, is the exact same stuff that they sell as slime in toy stores and at, you know, arts and craft stores for kids to play with. But it's got this corporate friendly branding on it. So what I think they missed is a huge opportunity to sell this as quote, Business Slime. That should have been the greatest name ever and they just missed it.

Mark: Oh yeah.

Kevin: So the idea is that this is so sticky that it just sort of... It's like using Scotch tape to kind of pick lint off of a shirt or-

Windell: Exactly. And the nice thing about it is that for certain types of subjects, and I think it has only very limited utility in a number of types of things that can be used on. But for those, it really works well. It's like a lint roller that goes weird places. So I came across this this past year while working on a major photography project where I was doing a whole lot of closeup and macro photography. And in that kind of photography, maybe 90% of your time is actually spent cleaning. That you just have dust everywhere. That even when you look at it under magnification, or even through your view finder on the camera, you won't be able to see the dust until they're in the final photos. So I used things like compressed gas dusters and cleaning cloths and so on. But your microfiber cloths still leave little bits of microfiber dust on your subjects. But this cleaning gel really was a first rate solution for dealing with tiny dust that you couldn't see, particularly for photography.

Kevin: But it has to sort of be a somewhat firm surface. It can't be kind of like a living surface or can it be?

Windell: Most of the subjects I was photographing were technological objects, let's say, or manmade objects that were not... I was not photographing insects and trying to smother them in a gel that I don't think would work. And again, I think the number of subjects that it can actually be used on is relatively limited. I wouldn't use this on cloth and I wouldn't use it on surfaces that need to be optically clear afterwards. But if you have a keyboard or mouse or you have a product that you're doing product photography of, this is one of those tools you should have in your kit.

Kevin: Right, right, right.

Mark: OK. I was confused at first. I thought you were pressing the slime against the lenses of your photography equipment to get the dust off the lens.

Windell: Well, there's actually a technique like that that's very different. I'll tell you about it just because it's kind of cool and as a diversion. There is a special type of spray. And one type of this has historically been sold is quote, metal blocking spray, but there's also versions you can paint on. And these are used for cleaning the most optically precise lenses and optics. So if you have an electron microscope and you have a big window that needs to be super clear or you work in vacuum or you have laser optics that you don't want to risk even lens tissue scratching, then you can spray or paint one of these things on. And it forms a skin that peels off all at once removing any dust or impurities with it.

Mark: That sounds amazing.

Kevin: It's back to that Scotch tape.

Windell: Ah, yes. But imagine the hundred dollars in application Scotch tape.

Kevin: Right. Yeah. The Business Slim that you're recommending, it seems to be the use case that the packaging presents is cleaning a keyboard. As you can imagine in your own

mind's eye, there's all these crevices in a keyboard and how can you otherwise really clean them? So you press the slime, this gel and it stickies up everything that's movable.

Windell: And you have to do it just right so you don't push it far down enough between the keys that it stays there.

Kevin: That's true. Well, that's fantastic. So I think it's called, well, the one you're pointing to called Keyboard Cleaner.

Windell: The one I link to is a brand name ColorCoral, and it's available in sort of big tubs or in little packets, little individual packets that zip seal. And I like the ones that are in the little packets so I can use one up and get it really nasty and open it up and have a fresh one.

Kevin: Yeah. Fantastic. Okay. That's something we haven't heard before. I can tell you safely, nobody has recommended that one before.

Windell: Well, it's useful for only some specialized weird use cases, which is I think what you want to hear about.

Kevin: Exactly. So tell us about a fourth tool that's a favorite of yours.

Windell: All right. So one of the hobbies that I have is amateur astronomy and I volunteer at an observatory and go out and help people see the stars and planets and things. My own telescope at home, though, is an Orion SkyQuest XT8, which is a very basic Dobsonian telescope, which is to say that it's one that you set up on the sidewalk by just picking it up and setting it down. There's no computerization, there's no motors, there's no weights to set up, and no tripod. It's just, you point it by pushing it towards the thing you want to look at. And then you look through the eye piece. And so you can set down and on a good clear night, you can plop the thing down on the sidewalk and 30 seconds later, you are counting the moons of Jupiter and checking their positions.

Windell: This is actually one of the most popular telescopes that there is for amateur astronomers. And it is also somewhat universally recognized as the single best starter telescope for someone who might get into serious astronomy. Because it's much, much better than the sort of a hundred dollars toy level ones. And it's about \$550 right now, but the price has varied quite a bit. It's one that is expandable by adding better eye pieces to and better instrumentation to be a very serious scope. And it has a big enough mirror, eight inches in diameter, that it collects a whole lot of light and lets you see things that are honestly quite hard to see.

Kevin: And how big is the entire unit you mentioned going to the sidewalk? Is it five feet high or how tall?

Windell: I think it's about four feet high, but that's just my quick impression. It's a little heavy to carry by one person. It splits into two pieces, so you can carry them each fairly easily. And it fits pretty easily in a car trunk or hatchback to go places. But I can't say enough

good stuff about this telescope after having had it for several years and, time and again, when I look at what telescope people recommend as a starter, this is the one they pick.

Kevin: Just to be clear. I know that Orion makes a bunch of different Dobsonian versions, but this one is, I think there's a XT8 and I don't know what the eight, maybe it's eight inch. Is that the idea?

Windell: That's right.

Kevin: So you can get a six inch maybe you want it smaller, but you want the eight inch one.

Windell: Yeah, there's a six inch. There's the eight inch, XT8. There's an XT10. And I think they go up to at least 14 inches in these models. The size to the mirror, the diameter of the mirror, really reflects how much of star light falling on earth that thing collects and points at your eyeball. So it's power and we don't mean magnification, but I mean it's light gathering ability really is strictly determined by that  $r$  squared. By your amount of area that that mirror takes up.

Windell: So there's this saying amongst the astronomers, you know, what's the best six inch telescope and the best six inch telescope amongst any other feature you could pick on a six inch telescope would instead to be to get the eight inch. So the thing that you recommend is you're going to get the bare basic eight inch telescope because it's really at the sweet spot of usability. Being big enough to be a really great instrument and being affordable enough. And, you know, if you find that you're using it a lot, then next year after you've had it, get yourself a really nice eye piece. You spend a hundred bucks and you have a brand new telescope with twice the capability. So...

Kevin: So is it the idea that the eye piece is really where the magnification happens and the base mirror is really where the light is gathered?

Windell: That's right. So this is a type of Newtonian telescope. Dobsonian specifically refers to the mounting technology where it's just sitting in a little flexible cradle on the ground, rather than a balanced telescope mount that points at the north star. A Newtonian telescope has two elements, which are the mirror, which collects light and it's curved mirror. And it points that to a focus. And near the focus, you have a eye piece, which refocuses it to your eye. And the diameter of that eye piece and the quality of that eye piece and the focal length of that eye piece determine how big of a field view you have both in terms of magnification and when you look through it, are you seeing a 20 degree view of the sky with your eye, or are you seeing a 50 degree view of the sky with eye?

Windell: And one of the biggest differences between the starter kit and a really nice version of this is you can put on a nice eye piece that gives you a much wider view of the sky. And I don't mean lower magnification, but that when you look through the telescope, you're really immersed. You're not seeing a small part of your field of view, but a large part field of view is filled up with stars.

Kevin: And I imagine a more expensive one would be ones that did both high magnification and large field of view?

Windell: That's right. And Orion does make some spectacularly good eye pieces that work with this telescope and are quite affordable.

Kevin: So there's a whole upgrade path by just replacing the eye pieces.

Windell: Yeah. And there's other accessories like different types of sights that you can get, but it's just such a good ecosystem that if I... I should say, when I am asked by somebody, "I'd like to get into astronomy, what telescope should I get?" Without hesitation, this is the one that I'd recommend every time.

Kevin: That's fantastic. Is there like a little tiny side scope or something that helps you aim things?

Windell: Yeah. There's a little finder that's included with the base model that I think is kind of junky. It has an LED or maybe even a little laser that it projects that essentially goes into your field of view. And you point the little red dot at whatever you want to look at. I've actually replaced the one on mine after upgrading it with a special type of sight that essentially works in a similar way but as a higher quality version. It's called a Telrad Finder and the Telrad just makes it very easy to find what you're looking for.

Windell: But how to find things in the sky, especially in a sky that is got light pollution is one of the hardest things in amateur astronomy. And it's very easy to see certain nebulas, if you can just point the telescope in the right place. And when you are sitting out there on the curbside with your stool and your telescope, oftentimes a lot of what you're doing is pointing the thing around trying to find something.

Kevin: Yeah. So it sounds like that maybe this is a popular enough starter telescope that there may be kind of like a community of add-ons and third party paraphernalia and other things that it's kind of almost like a platform?

Windell: There is, but it's more the case that the types of accessories that it takes are a little bit universal. So for example, the eye pieces come in two sizes, which are a 1.25 inch and 2 inch, are their trade names, trade size names. And this telescope can take either of them. So it comes with a little medium quality, 1 1/4 inch eye piece. And then hopefully if you're having fun you upgrade to a nice quality 2 inch I piece later. And most of the other things like those sights will work on a huge range of telescopes. This really isn't the kind of telescope that is good for astrophotography, because it doesn't have a motor and it doesn't have automatic pointing. But if what you want to do is visual astronomy, it really can't be beat as a starting point.

Kevin: That's fantastic.

Mark: Windell, before we go, I wanted to make sure we could talk a little bit about the plotting robots that you have been making for quite a few years now. What's going on in that world?

Windell: Right, so my background is in atomic physics, but I find myself somehow designing and manufacturing pen plotters for a living.

Windell: So our company, Evil Mad Scientist Laboratories, started out primarily doing things like soldering kits, but gradually evolved into doing pen plotters as our primary business, starting with the EggBot in 2010 and WaterColorBot in 2013. And since 2016, we've been primarily building a pen plotter called the AxiDraw, which is just a modern and simple pen plotter that can hold a pen. And they're widely used for things like generative artwork when artists who design artwork by program and the computer want to make things that make archival versions, not a computer screen printout, but you've got a fountain pen with archival ink on acid free paper, and hang that in a gallery.

Kevin: What's the next step in that for you? Or what are you looking forward to in terms of pen plotters?

Windell: We are always looking to make better ones. Right now we make sort of a low cost machine that we quite a lot of, and there's a sense in which would be nicer to make fewer higher end machines, but it's just gradual evolution. One of the things that a lot of people use them for are addressing envelopes to make envelopes that look handwritten, and we've also built some tools to sort of address that market. I don't think it'll ever be as popular as pen plotters were in the 1970s, but there is a niche for it. And it's a fun niche, especially because we get to serve those artists.

Kevin: Mm-hmm (affirmative). I had a friend who just built a really big version using kind of like a CNC machine. He wanted to do huge versions, which he kind of did by himself. You say you're making expensive versions. How big are they?

Windell: The biggest one we make right now is essentially an A1 size plotter, which is to say it prints on paper up to 34 by 22 inches or so. But most of them are desktops size instead.

Kevin: Okay, great.

Mark: Very cool. And so where can people find out about them by going to-

Windell: At axidraw.com. A-X-I-D-R-A-W.

Kevin: Does it come with its own software or does it use generic plotting software of some sort?

Windell: We actually have written all the software that it runs on and we've written it as a set of APIs, but we also have integration into the open source program Inkscape. So a huge

part of my job in real life is not just designing the hardware, but also writing the software and making sure that that really works well and is reliable.

Mark: And Inkscape's kind of like an Adobe Illustrator free version.

Windell: That's right. It's an illustration drawing program that primarily outputs SVG graphic, and it's a lot like Illustrator or CorelDRAW in its basic set of capabilities.

Mark: Yeah. Pretty powerful software to have used it before for [inaudible 00:30:11] forge.

Windell: I have used it a lot for a long time before we started making machines that worked with it. So it was sort of a natural integration.

Mark: Sure. Well, Windell, this has been great talking to you and catching up with you, finding out about some of your tools. I'm sure we just barely scratched the surface of what you have. So we will be knocking on door again one of these days.

Windell: Such a pleasure to be back and hopefully next time I can be on I'll have a new book to tell you about.

Kevin: Well, that would be fantastic.

Mark: Cool.

Kevin: Looking forward to that, let us know.

Mark: That sounds good. Do you have a title yet that you can tease us with?

Windell: I'm not teasing anything yet, except that there will be a book and I'm excited about that.

Mark: Sounds good. Well, thanks so much, Windell.

Windell: All right. Thank you both.

Mark: Hey, everybody, it Mark from the Cool Tools podcast. I want to thank you for being a listener to Cool Tools. And I also would like to let you know about our Patreon page. If you would like to support the Cool Tools show, as well as our video channel, the website, and all the newsletters that we do, you can go to [patreon.com/cooltools](https://patreon.com/cooltools), that's just one word, cooltools, and pledge any amount you want, you could even pledge a dollar a month. Every little bit helps. We have editors. We pay for transcribing costs. We pay our reviewers. Every bit of money that you contribute goes towards supporting the show.

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