

DRONES * ROBOTS * VIRTUAL REALITY

Build This Micro
FPV Quad Racer

Make:



CYBORG & THE SINO:BIT

BRINGING OPEN SOURCE HARDWARE TO CHINA

**MAKERS OF SHENZHEN
CHINA'S SILICON VALLEY
OF HARDWARE, POP. 12M**

**DIY
DISASTER
RELIEF**

**LOTS OF
PROJECTS!**

**DAZZLING
RAINBOW
LIGHTBOX**

**DOGGIE TREAT
DISPENSER**

**BUDGET ROBOT
RADAR**

**TWIRL-A-SQUIRREL
BIRD FEEDER**

BIGFACE BOX

LED BROOM

AND MORE

Naomi Wu
aka @realsexycyborg



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Written by Naomi Wu

AND THE SINO:BIT

Shenzhen's prolific maker details her journey, her inspirations, and putting together China's first certified Open Source Hardware project

I'm **Naomi Wu** (@realsexycyborg on Twitter), a 23-year-old maker and hardware enthusiast from China. I live in Shenzhen, also known as the "Silicon Valley of Hardware." Chances are your phone or computer was made here — maybe even by a girl I grew up with. It's a city straight out of cyberpunk, on the cutting edge of tech, and it's growing at an amazing rate. I'm right in the middle of it.

Shenzhen is located in Guangdong province, Canton by the old spelling, so I'm Cantonese. It's right across the border from Hong Kong and, at less than 40 years old, is one of the youngest cities in China. Our culture reflects that; I'm

told we're a bit like New York — people come from all over to change their life and make their fortune. We are fast moving and ambitious, but tend to be less conservative than other Chinese cities. "Local" cuisine is from all over China — and increasingly the West.

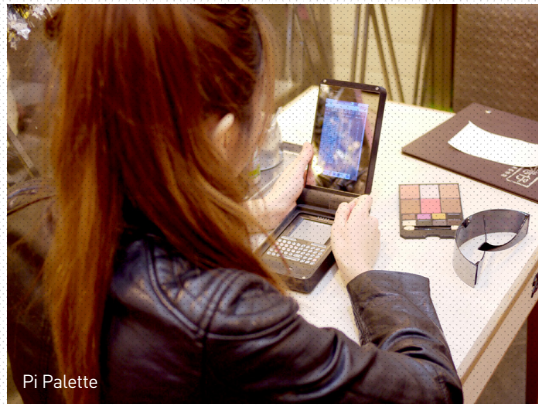
Shenzhen used to be known as the Shanzhai capital — Shanzhai being our term for copycat or cloned products. Obviously, we know this business model of just taking other people's ideas and making them is not sustainable. We'd all be factory workers forever if we did that. So there's been a tremendous amount of thought and resources put into fostering an environment of creativity and innovation. More than anything, I'm the result of

this supportive environment, millions of people sharing a common goal and value — to have, and produce the products of our own ideas. To be creators, not laborers. So when I show off one of my creations in public, be it my wearable 3D printer or skirt made of infinity mirrors, everyone is delighted, because as foolish as they are, it's creative foolishness and something we are all striving for. Seeing some rich boss pull up in a fancy car, this does not make anyone happy. But taking a selfie with the weird local girl riding the metro with a working 3D printer on her back? Everyone smiles because this represents the creative, interesting city we all want. It is also something that does not come easily given many of our traditions.

Photos Courtesy of Naomi Wu



Hikaru Skirt



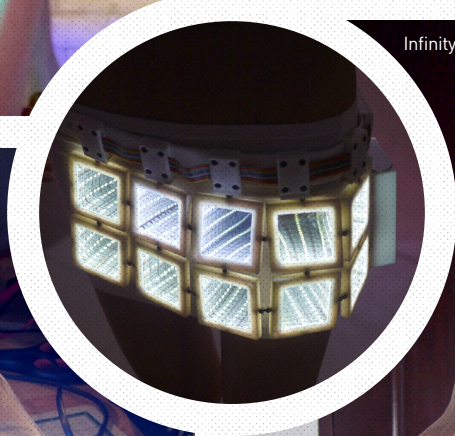
Pi Palette



Poor Girl's Monocular Display



LED Heels



Infinity Skirt



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A CRASH COURSE IN MAKING

I was educated locally here in China — what in the West you would call public schools. I come from a fairly typical working-class background. I think the education I had was good given the resources available — if not as comprehensive as a Western one. It was, however, strong on math and science which I am grateful for now given my involvement in tech. I was a bit of an English geek, studied constantly and watched English TV late into the night, every night since I was a child. Because of this, I was able to win awards in local contests for my English. This proved to be an advantage when I attended college as an English major and needed to earn some extra pocket money, as it enabled me to learn to code online and become a freelance web developer. Web development exposed me to startup culture, then to the local Shenzhen hardware startup and development scene. There are many Westerners in Shenzhen doing hardware development, and from talking to them I heard about maker culture, hardware hacking, and infosec — enough to spur my interest to study these things more on my own and eventually become a maker. My first hardware project was for a Maker Faire after-party in 2015. It was a skirt under-lit



Pentesting shoes



At work high above Shenzhen



Bangkok Mini Maker Faire

Photos Courtesy of Naomi Wu

with LEDs based on a Japanese design by Kiyoyuki Amano — the Hikaru skirt. I had access to a 3D printer, had completed the Tinkercad tutorials, and had been using them to make some small gifts for friends. A simple enclosure for the control board and battery I had purchased was just a matter of printing and revising the design a few dozen times until everything fit. From my software development and use of open source tools I knew the importance of attribution so was very careful not to take credit for the skirt's concept. The creator and the Japanese maker community appreciated this, because it's unusual for Chinese to be so careful about attribution, and they reposted the pictures of the skirt. This was an important early lesson for me — you get more respect through proper attribution than you do by claiming others ideas as your own. Eventually, the skirt made its way onto Western websites. For a regular girl from a city of 12 million, to suddenly have her picture in the West — this was quite something. It's easy to feel invisible and lost in a mass of humanity here. I'm not ashamed to admit that more than a little bit of vanity drove those early days of late nights over the soldering iron. But I matured and while I still love the

presentation and performance of showing off something I make, love of the build itself has surpassed these elements. In the following two years, I kept up as good a pace as I could while working full-time, with a new project every two months or so. I created 3D printed heels with pentesting (hacking) tools built in, arm-mounted micro drones, a skirt made of infinity mirrors, a burlesque-inspired top made of LCD shutters (I had something underneath for modesty, of course), a makeup palette with a Raspberry Pi built

Making is not a purely technical pursuit, there is a bit of performance art to a lot of it as well.

in for more network pentesting, a device for a small drone to deposit a Wi-Fi-hacking payload and fly away, and more.

Of course, since I became an adult I have had a very flamboyant personal style — I know that played a big part in the exposure I received for these projects as well. Making is not a purely technical pursuit, there is a bit of performance art to a lot of it as well. Presentation often plays a role and you can't unscramble an egg and separate that from the technical merits of the project. But if I

had not wanted to be the sort of person who stood out in a crowd it's unlikely I would have been attracted to making and fashion tech — activities that are ideally suited to this kind of creative personal expression.

The Asian tradition of pretty girls doing creative things, I suppose Westerners would be most familiar with the Japanese geisha, originated in China, of course. We've been doing it for thousands of years and there is no conflict; it is our ideal. People from other parts of the world, with different tastes and artistic

traditions may find it all a bit surprising. I do what I can to accommodate but I am Chinese after all, so mostly concern myself with our traditions. So long as old ladies laugh, smile, and take pictures with me I don't worry too much.

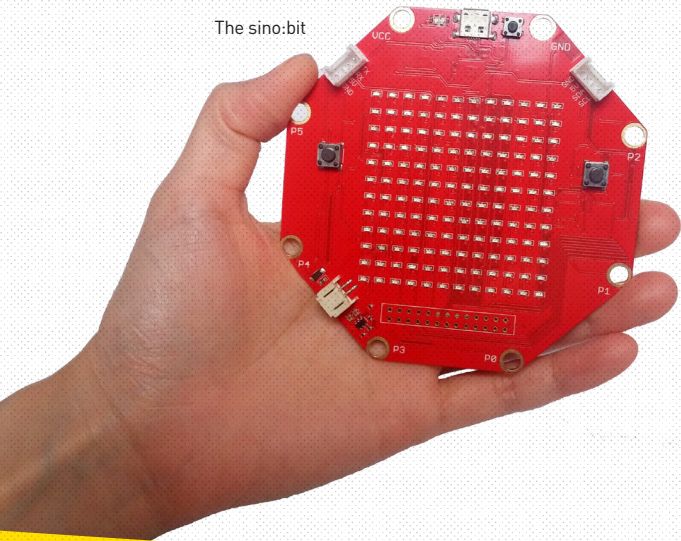
LEVERAGING SHENZHEN WITH THE SINO:BIT

In addition to the projects I build myself I recently collaborated in the creation of an educational board called the sino:bit. The project came about as I began to see a pattern, most

of the Westerners coming to Shenzhen to have hardware made were men, and most of my online friends in maker education were women. These women knew exactly what was needed in their classrooms — Pi Hats and Arduino Shields, specialty RGB LED displays. All sorts of things, all very specific, and very practical ideas. But they had no experience in manufacturing and were a bit reluctant to get on a plane to a non-English speaking country and make a go of it alone. For that matter they were a bit concerned if they could even get it made after crowdfunding it. There are just not many women they could speak to who had produced simple hardware in China successfully on their own.

This coincided with an interest I had in the BBC micro:bit. The micro:bit is a brilliant piece of engineering for education, but like many open source projects part of what makes it so great is the ease with which it can be tailored to different needs. From talking to maker education people here in China the first, most basic step of programming — Hello World — was being glossed over or bypassed entirely. "Hello World!" just does not have the same thrill when it's in a language you

The sino:bit



Wearable 3D printer



Young Naomi



can barely read. U.K. children would not have much interest in spending an hour learning to write “你好，全世界！” on a display or showing it to their uncomprehending parents. So instead Chinese kids wanted to make a robot. The micro:bits were almost never being used here without an add-on board for driving motors. Troubleshooting the interface between the micro:bit and the connector slots on those boards was taking up valuable classroom time.

I came across the German version of the micro:bit — the Calliope Mini. It seemed that many of the issues we had in China — localization and an easy way to drive motors — the Calliope team had already solved. So with their permission, I proposed a Chinese derivative of the Calliope Mini — largely the same, backward compatible with both the Calliope and the micro:bit but with one important difference. The sino:bit would have a 12x12 LED matrix instead of 5x5 so that it could display any non-Latin language — not just Chinese characters,

but Japanese, Arabic, Thai, Hindi. Kids could experience that first thrill of “Hello World!” in their mother tongue. Not only that, their parents could read messages — holiday greetings, “I love you Mom,” even religious messages programmed by their children. It is hard to overstate the role of the written word in Chinese culture and education, suffice to say it is inseparable. The sino:bit takes the amazing engineering that went into the micro:bit and Calliope Mini, and tailors it to fit Chinese culture and educational tradition — instead of expecting us to change to fit another culture’s language and traditions.

So with this project and the concerns about manufacturing difficulties faced by my female friends in maker education in mind, I contacted a local electronics manufacturing company called Elecrow. The idea was they would do the

engineering on the sino:bit to bring the idea to life, and even though we are all Chinese we would conduct and document the entire process in English. I would even visit the factory speaking only English to the taxi driver, showing the address written on a piece of paper in Chinese.

All this to answer one

question: Could a typical online friend of mine describe her idea and have it manufactured, entirely in English? Either simply over email or with a visit to

“Hello World!” just does not have the same thrill when it’s in a language you can barely read.

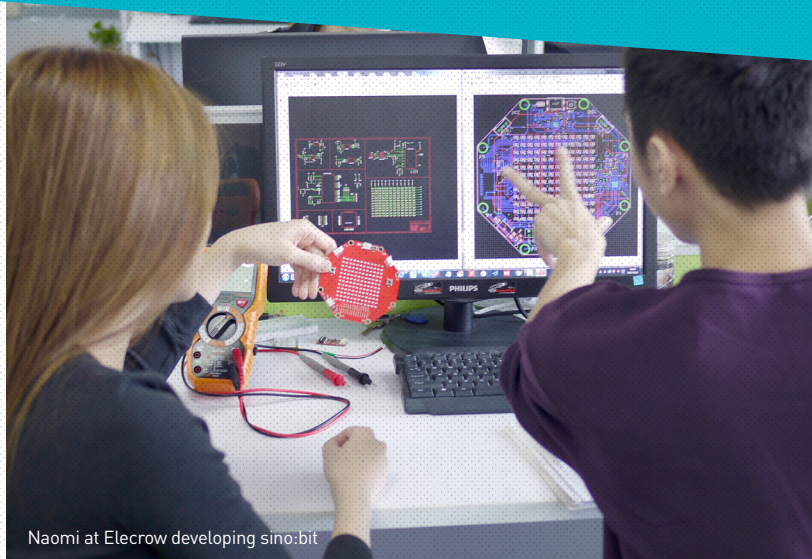
Shenzhen to oversee delivery? I envisioned a Western woman in maker education, capable of programming and teaching Arduino or other basic electronics, but without PCB layout or electrical engineering experience. What sort of pitfalls were there to be aware of? Can you really just have someone else do all the engineering based on your general idea of

how it should work? I made certain it was challenging for Elecrow — I refused to reply to Chinese messages when they wanted something clarified, was deliberately vague, constantly told them to do what they think is best, and in general insisted on the sort of initiative that I knew Westerners encouraged but that we find difficult. I often joked I was “red teaming” Chinese hardware development — taking a joke from infosec.

It was my first hardware development project, and a learning experience for everyone. But in the end, we became the creators of the first Open Source Hardware Association certified project in China. The publicity has more than paid for the time they put in — something that other companies have noticed. Those companies have started to reach out to me about how to go about getting involved in open source projects of their own, to raise their profile in the hardware community and show they understand these values. All this along with the growing interest in the sino:bit



sino:bit production line.



Naomi at Elecrow developing sino:bit



Becky Button

as an educational tool for Chinese children, is, of course, immensely gratifying.

CHINA'S OPEN SOURCE CHALLENGE

Recently, in order to have more content on my YouTube channel in between builds, I've started shooting videos reviewing local products made here in Shenzhen. I'm quite careful not to endorse anything shoddy, or poorly made, and this has lead to local companies reaching out to me asking me to help make Western customers more aware of them. This creates some interesting opportunities for advocacy and cooperation between Chinese and Western hardware communities.

My open source interests and video creation recently converged with one specific interaction. There's a fairly well-known 3D printing company here in Shenzhen — Creality 3D. They had invited me to shoot a video of their factory. It was a little ways out of my way — about an hour from my house, so I had been dragging my feet a little. Around the same time the

Marlin firmware development team — that's the program that runs a lot of 3D printers — was complaining that Creality had not been publishing the changes they made to the code as dictated by the license terms. So I thought to myself to have a try and half-jokingly told Creality I'd visit the factory if they published the code. They immediately agreed. This was quite a surprise because open source compliance is normally quite tough in China. So I went and did the best job I could with the video, in part because it's a pretty typical Shenzhen factory and I think it's important for people to see most are perfectly reasonable places, and that the bad factories are few in number and quickly disappearing. But also because I wanted to do everything I could to support and promote a Chinese company willing to at least take a very unusual first step towards abiding by open source community standards.

I did the tour, spoke to the workers and bosses, and on my way out they very kindly offered me one of their 3D

printers — a very large one called the CR-10s. Now, I'm already running out of room in my little apartment workshop. I have one large printer and an additional one would just be wasteful. So I was going to refuse but had a thought, so said — “Boss, everyone has seen your printer reviews, but you have no community engagement. Why not do what Josef Prusa and LulzBot do and show not just your product, but the values of the company behind it? I know a teenage maker in America — Becky Button. She's sharp as a tack, makes great things, but does not have her own 3D printer or very easy access to one.” I took out my phone and showed the boss Becky's project that I had given her a bit of advice on — sandals that can disconnect Wi-Fi around them. Well that was that — we are Chinese after all and if a smart kid needs something educational, and there is face to be had by providing it, it's going to happen. They loved the idea and Becky got a printer. Culturally for us this is quite a big step and a

success I hope to be able to repeat with other companies. Tools and making are closely associated with men in the mind of many manufacturers, so it can be hard for female makers, educators, and vloggers to get sponsors and review units. I'd really like if I could help address this.

I strive to facilitate this sort of interaction, to talk to Chinese companies and say, “This is why people are annoyed with you,” or talk to the maker and hardware community and say “OK this is why this is happening at this company.” It's very exciting and rewarding being able to act as a bridge, in even the smallest ways because there is a tremendous amount of miscommunication but honestly far more similarities in terms of creative spirit and values than there are differences between China and the West. I'll always want to make things, but this sort of combination of diplomacy and evangelism for the hardware and maker communities is really fulfilling and something I hope to be able to do more of. 🚀

Photos Courtesy of Naomi Wu