

Hacking with Chinese Characteristics: The Promises of the Maker Movement against China's Manufacturing Culture

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Abstract

From the rising number of hackerspaces to an increase in hardware start-ups, maker culture is envisioned as an enabler of the next industrial revolution—a source of unhindered technological innovation, a revamp of broken economies and educational systems. Drawing from long-term ethnographic research, this article examines how China's makers demarcate Chinese manufacturing as a site of expertise in implementing this vision. China's makers demonstrate that the future of making—if to materialize in the ways currently envisioned by writers, politicians, and scholars of the global tech industry—rests on taking seriously the technological and cultural fabrics of professional making outside familiar information technology innovation hubs like Silicon Valley: making-do, mass

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production, and reuse. I trace back to China's first hackerspace, documenting how a collective of makers began to move away from appropriating Western concepts of openness toward promoting China as source for knowledge, creativity, and innovation. This article demonstrates that when China's makers set up open hardware businesses and articulate a unique culture of "hacking with Chinese characteristics," they draw boundaries between the professional making they saw embodied in Chinese industrial production and the hobbyist making embodied in Western histories and cultures of hacking. In so doing, they position China as site of both technological and cultural expertise, intervening in dominant conceptions of computing that split manufacturing and innovation along geographical lines. This article contributes to critical scholarship of innovation and making cultures, technological expertise, and authorship.

Keywords

other, expertise, labor, politics, power, governance

Introduction

On a humid day during the summer of 2011, I returned to one of the key sites of ethnographic research I had begun a year earlier: XinCheJian (新车间)—China's first hackerspace. XinCheJian's membership had grown substantially since its inception in 2010 and the three cofounders had decided to give up their small sublet in a coworking space and moved into a place of their own. Covered in sweat but beaming with excitement to witness firsthand XinCheJian's rapid transformation, I had made my way through the old streets of Shanghai's West side, when I spotted from a distance XinCheJian's new home: an old warehouse located at the end of a tiny alley, where craftsmen, industrial workshops, and small vendors lined up to offer services for anything in need of repair; cars, bikes, phones, computers, radios, air conditions, and more. When I stepped inside the old building, cool air and quiet made for a sudden change of scenery. The thought crossed my mind that the old factory building—with its unfinished paint, large ceilings, and heavy concrete floors marked with scratches from heavy machinery—constituted an ideal place for the expanding hackerspace and the particular kinds of technocultural work its cofounders intended to both enable and represent. Inside, I found David Li (李大维), one of the three cofounders, adjusting an array of plastic tubes that made up one of his latest projects: aquaponic planting. "It's pretty cool uh?"

David welcomed me back with a smile, waving me closer and continuing: “it’s just so cool to grow plants without soil!” What made aquaponic planting not just cool, but also interesting, he elaborated further, was that the water stayed in the system to be reused, whereas the plants receive nutrition from the fish in the water and in turn clean the water from the fish’s excrement. The system not only saves water but also avoids the release of nutritional pollution into the environment, as can be the case in soil-based planting. Our conversation then moved to the topic of reuse and e-waste. Many hackerspaces, David stressed, promoted principles of resourcefulness, reuse, and peer production. They shared the belief that the rise of open source hardware constituted an opportune moment to proliferate civic engagement in matters of public concern such as preserving the environment, sustainability, pollution, health, and so on. Yet for David, something important was missing from these conversations; “just look outside this window, and look at what the workers are doing on the street and in these little shops,” he explained. “That’s a real dealing with e-waste. Not just this elite form where people promote reuse, because they want to feel good about themselves purchasing a new phone every 6 months. Here, people reuse on a daily basis discarded parts and fix broken machines rather than buying new stuff. It’s making out of necessity. It’s open source hardware in practice. This is different from the West where open source hacking only exists in theory. Here, the actual maker in the factory is involved, the workers, the repair guy on the street. Our hackerspace in Shanghai is getting at this. It’s going to be a hackerspace with Chinese characteristics.”

Drawing from ethnographic research I have conducted in China over the last five years, in this article I unpack what led up to and followed from David Li’s articulation of a “hackerspace with Chinese characteristics.” In doing so, I demonstrate how a particular claim of expertise—that Chinese manufacturing constitutes a site of expertise in technological innovation, design, and knowledge production—came into being and was sustained over time through both ideological work and entrepreneurship.

Like the other facilities that have sprung up around the world under the “hackerspace” umbrella, XinCheJian is a loose collective of volunteers who run and use an informal drop-in workspace where people get access to 3-D printers, laser cutters, and other machines and technologies for open hardware projects. Similar to hackerspaces elsewhere, its members advocate an understanding of technology innovation rooted in reuse and resourcefulness rather than building from scratch. Unlike some of those other spaces, though, the wider collective of hardware enthusiasts that has formed around XinCheJian was oriented toward unsettling dominant cultural

meanings and political narratives of industrial production, manufacturing, and technology innovation. This article illustrates how the founding of China's first hackerspace set in motion a shift in attitude that shaped the organization of technology businesses, technology productions, and writings on digital culture across regions in China. It was a shift from appropriating Western concepts of the free culture and open source movement toward developing a concept of technology innovation and ingenuity rooted in the specifics of Chinese history and culture of production: hacking with Chinese characteristics.

A dispersed collective of self-identified “makers” began to form, focused on challenging Western authority and authenticity claims of where to locate technological expertise and what counts as innovation, open-source, creativity, and design. As I will show in this article, the phrase “hacking with Chinese characteristics” is indicative of boundary work (Gieryn 1983), which I observed more broadly among China's makers, aimed at legitimatizing Chinese manufacturing as a site of expertise within a global network of tech elites (Castells 2006).

The Promises of the Maker Movement against China's Manufacturing Culture

Between 2008 and 2013, the number of hackerspaces¹ in existence across regions doubled from an estimated 400 to over 1,000. Hardware start-ups that identify with the so-called maker movement have experienced significant economic success. Maker Faire, an outlet for individuals and companies to exhibit their projects, has steadily grown in size since it was first held in the San Francisco Bay Area in 2006 and now includes events in cities in Asia, Europe, and South America. In the broader imaginary, all of these developments—the rising number of hackerspaces, successfully funded hardware start-ups, and the expansion of maker events—are indications of a global maker movement. Publications like *Make Magazine* or the book “Makers” by Chris Anderson (2012), former editor-in-chief of *Wired Magazine*, have been crucial in instilling an imaginary of maker culture that promises technoscientific innovation by enabling new forms of citizen science and democratizing technology production (Currie Sivek 2011; Kera 2010). These publications promote “making” rather than “hacking,” in part to avoid connotations of illegality and cyber crime, and to remain open to funding agencies, and broadly articulate inclusivity (Lindtner, Hertz, and Dourish 2014). The promises of a better integration of society, the economy, technology, and science are roped into a powerful vision of change,

drawing media attention, political and corporate interest, and investment. For instance, in 2012, US president Barack Obama proposed a US\$1 billion investment for the buildup of a National Network for Manufacturing Innovation, stating “We’re Americans. We are inventors. We are builders. We’re Thomas Edison and we’re the Wright Brothers and we are Steven Jobs. That’s who we are. That’s what we do. We invent stuff, we build it.”² About a year later, in a 2013 State of the Union address, the president proposed that “maker” tools such as 3-D printing were crucial to ensuring “that the next revolution in manufacturing is made in America.”³ Promises of making also fuel visions of change in education and scholarship. Making has been framed, for instance, as an approach to reworking higher education, opening up fields of Science, Technology, Engineering, and Mathematics (STEM) to minorities, and providing a pathway to move out of the classroom and into engaged learning (e.g., Kolko et al. 2012).

Across these scholarly, political, and media accounts, “making” is positioned *against* passive consumer culture. I use *against* in the double sense of its meaning: “*in opposition to*” and “*in juxtaposition with*,” the former connoting a confrontation and the latter alignment or coexistence despite (or because) of difference. In other words, making is framed as being opposed to passive consumer culture while simultaneously offering to remake it by turning end consumers into technology producers and engaged citizens who address in a hands-on manner societal concerns, perform citizen science, and intervene in the market economy.

As I will show in the following pages, China’s makers demonstrate that the future of making—if to materialize in the ways as currently envisioned by writers, politicians, and scholars of the global tech industry—rests on taking seriously sites and social fabrics of professional making such as practices of repair, mass production, craftsmanship, and reuse that prevail outside of information technology (IT) hubs like Silicon Valley. It is China’s history and expertise in manufacturing, repair work, and mundane reuse that provide the foundation for implementing the vision of making as the harbinger of economic growth and tech innovation, and in ways that differ from those the West imagines. China, they proclaim, is already at the very center of contemporary design and innovation culture, rather than its periphery (Chan 2014; Takhtezev 2012). The promises of the maker movement here are positioned *against* the technological, economic, social, and cultural processes of industrial production specific to China. Only if people began to take seriously China’s manufacturing as a site of expertise, so China’s makers argue, would the inherent potential of the maker movement, that is, to democratize technology production, be realized.

My goal here is not to adjudicate the claims of China's makers or those of their fellow counterparts elsewhere. I will also not characterize making and hacking in China as a more authentic form of or a fresh take on innovation. Instead, I am committed to carefully unpacking any such assertions of newness and authenticity (Chan 2014; Suchman 2008). I explore what we can learn if we investigate Chinese manufacturing as a site of technological innovation and expertise. This is not about letting the subaltern speak. On the contrary, China's makers are members of a powerful and global network of technology producers. They are invited by the Chinese government to participate in discussions on technology innovation and policy, they travel nationally and abroad to speak about their work and visions, and they have access to diverse financial resources and infrastructures. My goal, then, is to trace how their visions took shape through their articulations and writings, capital investments, material productions, and social organizations. Throughout this article, I pay particular attention to the conjoined material, economic and semiotic productions that gave rise and propelled forward the vision of Chinese manufacturing as critical enabler of the global maker movement, tracing how machines, materials, human actors, political rhetoric, and institutions were co-constituted in its implementation.

Makers, Creativity, and Innovation in China

Throughout this article, I draw from ethnographic research I have conducted with China's makers since 2010. My fieldwork set out at a coworking space called XinDanWei (新单位) in Shanghai, which had brought together a growing collective of like minds committed to ideas of openness, bottom-up creativity, and new ways of working since 2009. It was at XinDanWei where China's first hackerspace, XinCheJian, opened its doors in the fall of 2010. Around the time that XinCheJian opened, a growing number of people had begun to identify with the label "maker" and only six months after XinCheJian's inauguration, six additional hackerspaces had opened across other Chinese cities.

By makers, I refer to those who think of themselves as working in the domains of making, hacking, tinkering, repair work, open source hardware, manufacturing, and do it yourself (DIY) production. I predominantly use the term maker and making, as they are the terms most widely used in China.⁴ China's makers include people who grew up in China, people who returned to China after study and/or work abroad, as well as people who came to China from elsewhere to manufacture products or to work in its expanding tech industry.

As part of my research, I spent several years studying the social organization and technology production of hackerspaces across Shanghai, Beijing, Shenzhen, Ningbo, and Hangzhou. In 2012, I joined as a researcher a start-up that began working in the manufacturing hub Shenzhen in the South of China to implement a product idea, moving from making and tinkering into production. This research included in-depth observations at a local hardware incubator and participation in such day-to-day business as visiting factories, electronic markets, and pitching in front of venture capitalists. In 2013, I began focusing, in particular, on the site of Chinese manufacturing, conducting interviews and observations at factories in Shenzhen (Lindtner, Greenspan, and Li 2015). Most of my in-depth and long-term fieldwork engagement took place in China (with most intense fieldwork periods in Shanghai and Shenzhen), but included participant observation as well as formal and informal interviews at over twenty maker-related events such as Maker Faires, Maker Carnivals, Dorkbots, Start-up Weekends, Arduino workshops, and BarCamps throughout North America, Europe, and Asia. This multisited nature of my work is essential for understanding deeply the diverse practices, visions, and goals that come together under the maker and hacker rubric (Coleman 2012) and how they travel and take shape across sites and over time (Appadurai 1996; Marcus 1995). Participant observation at hackerspaces included joining daily affairs such as space management, member meet-ups, open houses, and the organization of events. The research at the hardware incubator took place throughout the duration of the program and included daily observations at the office space as well as accompanying start-ups to factory visits. Fieldwork entailed collaboration on testing stencils for printed circuit board (PCB) soldering masks, testing and negotiating on the factory floor, but also on writing, media productions, and the organization of events. A central goal of this article, then, is to uncover both the articulations and material productions of makers—their writings, organization of businesses, and production of goods. Equally central to my ethnographic research is the study of maker cultures in relation to ongoing institutional, economic, and political transformations in China. I have conducted in-depth discourse analysis of Chinese media coverage, blogging, microblogging, and official policy documents with a particular focus on innovation and creativity discourse (Lindtner 2012, 2014).

Since the years of opening up, the Chinese government has been centrally concerned with change and in particular with the remake of the nation's stature in international comparisons. Since China entered the World Trade Organization (WTO) in 2001, the Chinese government has implemented a series of measures driven by the goal to move China away from its economic

reliance on manufacturing toward establishing a national creative and culture industry (Greenspan 2014; Keane 2010, 2012; Lindtner 2012, 2014). The goal of this political agenda has been to turn China into a leading information and knowledge economy that surpasses its reliance on “made in China” by developing new industries that produce innovation “created in China.” More recently, the Chinese government has begun to endorse “making” as part of its larger politico-economic effort of China’s redesign. During an official “inspection tour” to the manufacturing hub Shenzhen in January 2015, the Chinese premier Li Keqiang visited what the government considers important sites of Chinese innovation; the visit included not only big corporations such as Huawei and the private bank Qianhai Webank but also the local hackerspace, Chaihuo (柴火). Li Keqiang lauded Chaihuo for its entrepreneurial spirit and proclaimed that its innovation attitude was to be supported by government initiatives. A couple of weeks later, in a state council meeting, the government declared the buildup of China’s “Mass maker space” (众创空间) to promote innovation through venture capital, incubator hubs, and entrepreneurs.⁵ My underlying goal in this article, then, is to unpack why “making” is something that politicians as much as geeks, artists, entrepreneurs, and designers are getting behind.

There Is No Harm in Opening up

In 2009, the three organizers of a series of informal art-technology gatherings in coffee houses, galleries, and private studios across Shanghai decided to start a coworking business under the Chinese name XinDanWei (新单位 translated into English: new work unit).⁶ Similar to coworking spaces elsewhere, XinDanWei was established as a shared community space that provided desks and rooms for people to rent on an hourly, weekly, monthly, or yearly basis and that regularly hosted events around topics circulating in the fields of technology, arts, and design. What had bound the cofounders together was the shared belief that China needed spaces for people to explore new work and lifestyles. The weekly events at XinDanWei ranged from open-mic nights to weekend-long workshops and conferences that have become common in international tech circles: TEDx⁷ events, Bar-Camps, Start-up Weekends, Hackathons, Dorkbots, and so on. Through the shared office space and weekly events, XinDanWei brought together a larger collective of people who identified with approaches such as peer production, open sharing, open source, start-up culture, social entrepreneurship, human-centered design, and many more. More importantly, it also introduced such concepts to people in China, who had not heard of or

identified with them. Within a short time, XinDanWei had become well known in an emerging technology scene that spanned across multiple cities in China. The scene was comprised of other bottom-up initiatives similar to XinDanWei such as Neocha, Urban Youthology, HomeShop, Transist, and others, as well as individuals such as freelancers, academics, and professionals working in the tech industry. XinDanWei functioned as a hub that brought together people from diverse backgrounds and where new ideas and partnerships could be explored in a relatively safe and trusted environment (Lindtner 2012, 2014).

People who had rented office space and/or attended XinDanWei's weekly events were working in the fields of technology design, hardware and software engineering, the arts, advertisement, digital media and media broadcasting, journalism, and more. Despite their different occupations, many shared the belief that doing creative work means following an approach motivated by principles of openness. Openness, here, meant to work outside rigid state institution or large corporations.

Fundamentally, XinDanWei's goal was to enable others in China to "realize their dream," no matter if this entailed starting a jewelry business or becoming an electronic media artist. To realize one's dream and decide for yourself what your personal and professional life entailed, people in XinDanWei's wider network agreed, was something that was rare in China and that was neither familiar nor an accepted lifestyle. While their friends, colleagues, and parents strove for stability associated with such things as a job in a big corporation or state institution, home ownership, and stable family life, people at XinDanWei believed that China was in need of an attitude shift, one that was open to new ways of living. The coworking space was organized in a way that was conducive to inviting people in and giving off a vibe of openness and inclusivity. At a TEDx event in Shanghai, Liu Yan (刘妍), the CEO and with Aajiao (Xu Wenkai, 徐文恺) and Chen Xu (陈叙), one of the three cofounders of XinDanWei, explained to an audience of about sixty people: "What we do is innovation based on open sharing. XinDanWei means a new way of working. We show that this is very simple and not complicated to do. That everyone can do it. XinDanWei is a platform for building trust. We show people in China that there is no harm in opening up. At XinDanWei, we cultivate new ideas. China means creativity and creative people. So we are creating a work environment to stimulate the generation of new ideas, the cultivation of new ideas and creativity."

These aspirations of "opening up" China were enacted by translating Western concepts of open sharing, free culture, entrepreneurship, and risk taking into the context of China. Many drew on prominent Western writers

of digital culture such as Lawrence Lessig (2005), Clay Shirky (2009), and Howard Rheingold (2003), promoting digital technology as tool of empowerment and as essential in laying the foundations for a new society, where openness, acceptance, discussion, and participation flourish (Chan 2014). Having had access to these ideas through their personal and professional networks and/or through their studies or travels abroad, many in and around XinDanWei considered it their responsibility to put the theories and practices of digital culture into practice for Chinese audiences. The goal was to initiate Chinese digital culture by shaping and remaking (largely Western) principles of openness and freedom of expression. A particularly prominent piece of writing about how principles of the digital culture could be applied in China was the “Sharism” (分享主义) manifesto by Isaac Mao (毛向辉). Isaac Mao was not only a member of XinDanWei, he was also an acclaimed Chinese blogger, often also called “China’s first blogger,” (Stout 2011) who became more widely known because of his critical remarks on Chinese Internet censorship in an interview with the BBC (British Broadcasting Corporation) in 2010 (Nie 2010).

Mao argued that the principles of the free culture movement such as open sharing, remix, and peer-to-peer networking would enable important social change in China. Sharism articulated that digital content production and a commitment to open sharing would enhance not only the exchange of knowledge but also lead to the creation of new markets. Further, the Sharism manifesto stipulated that free and open sharing of information and knowledge was an aspect of human nature, currently restrained by the rulings of an authoritative class and its hierarchical structures. Sharism draws specifically on the writings of Ray Kurzweil, Manuel Castells, and Lawrence Lessig to articulate how a liberated (i.e., uncensored) digital culture would allow China return to its “natural state” of a “connected society” as follows:

The rapid emergence of social applications that can communicate and cooperate are allowing more and more people to output content from one service to another in a creative ecosystem. This interconnectedness spreads memes through multiple online social networks, which can reach a global audience and position social media as a true alternative to broadcast media. These new technologies are reviving Sharism in our closed culture. The missing pieces are open source hardware and software services that enable true freedom from top to bottom in the entire communication stack. (Excerpt, Mao 2010)

The opportunities digital technologies would provide for China’s social and economic future were, according to Mao, inadvertent and only temporarily⁸



Figure 1. Graphic accompanying Sharism ideology: “Liberate the creativity.”

interrupted by the limits of what he called China’s “closed culture.” With a “closed culture,” Mao referred to both the regulation of creative production and reproduction with copyright law and to the limitations to free expression through Internet censorship. The concept of Sharism was developed in tight collaboration with a group of people from the Creative Commons⁹ organization and received significant attention from Western journalists and researchers on the Chinese Internet (e.g., MacKinnon 2013). When Mao was a visiting scholar at the Harvard Berkman Center for Internet and Society in 2009, his ideas gained international and national attention in blogger circles and the wider IT landscape. Between 2009 and 2010, he was a frequent speaker at local events such as TEDx, design conferences, arts events such as the “Get It Louder” conference in Shanghai, the annual blogger conference that he had cofounded, and many more. He was also invited to speak at international gatherings and events such as the Ars Electronic Festival in Europe and gave numerous interviews with Western media outlets.

In and around XinDanWei, the Sharism manifesto was reworked and extended through a series of productions including graphic design, Sharism business models, and spatial redesign. Figure 1 displays one such graphic, entitled “Liberate the Creativity,” used for a TEDxShanghai event hosted

in 2010. It captures Mao's vision of individual empowerment that rests simultaneously on the abolishment of censorship or self-censorship and copyright law. Creative Commons logos fly freely among a group of studious children reading books alongside a line of athletics, whose sprinting symbolizes the liberation of education and free market competition from copyright law.

XinDanWei tightly collaborated with Mao on implementing Sharism as the coworking space's core business strategy: by helping establish an open society and economy, XinDanWei would help move forward China's sharing economy. The organization of the coworking space itself was considered crucial in accomplishing this project. The space underwent continuous spatial redesign, based on input from members and ideas discussed at events and meet-ups. The spatial redesign should reflect openness toward new concepts and ideas and demonstrate that the organization and culture of XinDanWei was shaped by its participants rather than by a top-down decision maker. Spatial redesign, here, constituted a particular mode of cultural production: by instantiating openness and free sharing in XinDanWei's space design, these concepts would also be practiced and lived. Chen Xu, one of the cofounders elaborated this as: "our daily operation is saying 'if you want, you can always find a way.' Come to our event, you can always find a way to try this or to join an open collaboration or open design project." The idea was that every single member of the XinDanWei network cocreated the coworking space. The goal was to make a platform that others could coimagine and coproduce, or as Chen Xu put it: "we wanted that people would come together to imagine a space . . . so we created a community and people participate in this creation process and by participating they are benefiting." The continuous redesign of the space was oriented toward extending a sense of openness and flexibility, motivated by bringing a larger public of like-minded people together who collectively "imagine a space."

In 2011, Mao moved from Mainland China to Hong Kong after a series of interrogations by Chinese officials in response to his writings and public lectures on Internet censorship. With Mao's departure, the local interest in Sharism slowly faded. In 2013, XinDanWei's cofounders decided they could no longer sustain the coworking space; the sharing business model in its implementation at XinDanWei had become unsustainable. What remained, however, were the alignments and connections made between China's tech scene and those committed to ideals of open source, free culture, and the like elsewhere. Members of the wider network that had formed since 2008, and propelled forward through the establishment of XinDanWei, had found a way to situate their work in China, *against* a strong governmental

discourse on creative industry development (Lindtner 2012) and *against* an international audience of technology producers, writers, and users. It was this positionality in national and international circles that constituted a critical base for the growing open source hardware and maker scene.

Shanzhai: China's History and Culture of Open Manufacturing

Since its inception, XinDanWei had hosted several events centered on making and DIY. It was in the fall of 2010, at a BarCamp at XinDanWei, when earlier ideas around open hardware and DIY making should turn into a concrete and sustained community effort. It was at this BarCamp, when David Li, Ricky Ng-Adam (伍思力), and Min Lin Hsieh (谢旻琳), the three cofounders of China's hackerspace, first met. Ricky and Min Lin had just recently moved to Shanghai for a job transfer from the Google headquarters in Mountain View, California, to the corporate offices in Shanghai. David was one of the event's co-organizers. At the event, Ricky gave a provocative talk about the state of innovation in China. He proposed that if China wanted to become innovative, its corporations, managers, and employees had to adopt a less hierarchical and more open business and work style, similar to the one he saw represented by Silicon Valley and Google. Ricky's talk ended in a heated debate about the supposed lack of Chinese innovation.

After the event, conversations at XinDanWei often came back to the topic of innovation in China. The conversations eventually evolved into a regular series of meetings, focused on principles of open innovation, DIY making, and open hardware and what their unique characteristics might be when applied in China. A couple of weeks later, what had started off with a series of informal events at XinDanWei and a heated debate at a BarCamp turned into the setup of a space, where Chinese innovation and open source production should be explored more tangibly: David Li, Ricky Ng-Adam, and Min Lin Hsieh rented one of XinDanWei's rooms and China's first hackerspace was born. The name of the new hackerspace, XinCheJian (新车间 translated into English: new workshop or new factory floor), should indicate the hackerspace's alignment with XinDanWei, "to keep with the theme of XinDanWei, danwei means workunit, and since we are making stuff, we called it XinCheJian, which means new workshop or new factory floor," elaborated David Li. Labeling a hackerspace as the new factory floor was indicative of where David Li envisioned heading in the long run: XinCheJian should constitute an interface with China's vast manufacturing ecosystem—hacking with Chinese characteristics.

Early efforts of the hackerspace were focused on promoting the idea of making, hacking, and open hardware in China as well as promoting XinCheJian internationally. XinCheJian joined the global hackerspace wiki¹⁰ and connected to makers and hackers elsewhere by traveling to Maker Faires¹¹ or visiting hackerspaces outside of China. These efforts gave China's nascent maker scene legitimacy, both in China and abroad, which in turn helped attract new members, media coverage, and collaborators. Through a series of workshops, the three cofounders brought together newcomers to open hardware, as well as people who had been active in open hardware production in China already for a while, but had not yet specifically promoted their work as or identified with the maker movement. Some of the earlier and most frequent events XinDanWei and XinCheJian hosted were "Roborace competitions," which attracted passionate roboticists. Ricky Ye (叶琛), one of the earlier and most frequent attendees of the Roborace, had studied robotics in England before he returned to China in 2010. In 2007, he cofounded a company called DFRobot¹² with a group of Chinese hardware enthusiasts distributed across England and China. The company had been working in the field of open source robotics since its inception, but had not specifically used labels such as open hardware or making in the promotions of their work. Meanwhile, in the South of China, in the manufacturing hub Shenzhen, another open hardware company had set up shop: Seeed Studio. The company was founded by Eric Pan (潘浩) in 2008 as a two-person start-up working out of a small apartment that grew quickly into a multimillion USD business. Both Seeed Studio and DFRobot quickly gained recognition in maker circles outside of China for their quality productions in open hardware platforms and for the unique services they offered; both companies' businesses are structured around enabling (mostly foreign) makers to move from prototyping (of one thing) into production (of thousands of things). They provide services such as in-house agile manufacturing, sourcing of components, and assembly. In doing so, they provide makers access to China's intricate social world of manufacturing and a culture of production that has evolved in the South of China over the last thirty years: *Shanzhai*.

"*Shanzhai* is . . . a unique innovation ecosystem [that developed in Shenzhen] with little Western influence, thanks to political, language, and cultural isolation," writes the American hacker Bunnie Huang on his website. "It feels like open-source, but it's not: it's a different kind of open ecosystem. Welcome to the Galapagos of Chinese 'open source.' I call it *gongkai* (公开). *Gongkai* is a transliteration of 'open' as applied to 'open source.' I feel it deserves a term of its own, as the phenomenon has grown beyond the so-called '*shanzhai*' and has

become a self-sustaining innovation ecosystem . . . *Gongkai* is a network of ideas, spread peer-to-peer, with certain rules to enforce sharing and to prevent leeching. It's very different from Western IP concepts, but I am trying to have an open mind about it. I am curious to study this new . . . ecosystem. For sure, there will be critics who adhere to the tenets of Western IP law that will summarily reject the notion of alternate systems that can nourish innovation and entrepreneurship . . .”

Bunnie Huang speaks of a manufacturing culture that has developed in Shenzhen over the last thirty years in the shadows of large-scale contract manufacturing and outsourcing plants. This manufacturing culture (known as *shanzhai* 山寨 in Chinese) comprises a horizontal web of component producers, traders, design solution houses, vendors, and assembly lines. They operate through an informal social network and a culture of open sharing that could be compared to the principles and techniques central to contemporary maker practice. For instance, a common practice of *shanzhai* culture is to openly share production-ready boards (*gongban* 公板 in Chinese) designed for end-consumer electronics (Lindtner, Greenspan, and Li 2015). The boards function similarly to open hardware platforms such as the Arduino in that they allow others to extend its functionalities and build new creations on top. The *gongban* differs, however, in that it is used during prototyping and design for production and mass manufacture. Building on top of the *gongban*, companies can move from idea into production of a new smart phone or smart watch, for instance, within twenty-nine days.

When David Li envisioned a “hackerspace with Chinese characteristics,” he invoked exactly this history and culture of open production. *Shanzhai*, in other words, became a productive trope to challenge a unified Western story of what counts as “proper” open hardware or as authentic history of counterculture. “It’s the long lost twin of open source,” David Li likes to say, emphasizing *Shanzhai*’s connotation of countercultural ideology: *Shanzhai* translates into English as mountain stronghold or mountain fortress, and connotes an informal, outlaw tradition. The term has been in use in China for a long time and features most prominently in folk stories like the *水浒传* (*Shuihuzhuan*, translated into English: water margins) that tells of the adventures of 108 rebels, who hide in the mountains and fight the establishment. When the term was applied to manufacturing, it described a countercultural spirit of a growing number of factories that had begun repurposing discarded phones as well as branded devices to cater to new niche markets, often people who couldn’t afford the branded Gucci bag, or Apple iPhone. *Shanzhai* production today includes copycat versions of the latest iPhone side-by-side newly branded phones and tablets sold in the millions to markets

in India, Africa, and South America. *Shanzhai* is a big industry that is utilized for their distribution capacities and speed to market by Western corporations including but not limited to Intel, Google, and Microsoft.

“The practice of piracy itself is by no means unique to China,” David Li characterized *shanzhai* in a 2014 interview, “every country has it. In the West, they call it piracy. But in China, we don’t really have a piracy story. But we have *shanzhai* folk stories . . . there is an old saying 天高皇帝远, which translates as the mountain is high, the emperor is far, which speaks to the fact that *shanzhai* works from within the system, but far from the center (from the emperor), so they don’t follow all the rules.”

In their promotions of *shanzhai* as China’s homegrown open hardware and maker culture, China’s makers challenge claims of a global maker movement that subsumes local practices in the visions and historical references to American digital culture. They call upon Western makers and companies to take China seriously as partner in delivering on the promises of the maker movement. This is reflected not only in David’s notion of “hacking with Chinese characteristics” or Bunnie’s promotions of *gongkai* but also in the ways in which China’s makers have set up and structured their open hardware businesses. Take again, for example, DFRobot and Seeed Studio, the two open hardware companies that coincided with the advent of and propelled forward China’s maker scene; both businesses revolve around providing hobbyist makers and start-ups access to China’s manufacturing culture. This is different from companies like Arduino and MakerBot Industries, whose businesses revolve around enabling makers, artist, and educators to participate in hobbyist production, prototyping, and tinkering (Mellis and Buechley 2014). What I would like to emphasize is that DFRobot and Seeed Studio, in taking manufacturing itself seriously as a source of knowledge and expertise, did not only develop a niche business but also performed important cultural work. In conceiving a new mode of technological production, they repositioned Chinese manufacturing from a site inherently associated with cheap low-quality production to a site of expertise.

“When I came to the US in 2010, people there knew us and liked our products, but nobody wanted to believe that we are a Chinese company,” Eric Pan, founder and CEO of Seeed Studio recalled during an interview with me in 2013. “Nobody had thought that cool and innovative products could come out of China. That’s why, ever since, we at Seeed Studio have been using ‘innovate with China’ on our product labels to demonstrate that manufacturing in China can mean ‘partnership’ and innovation instead of cheap labor and low quality . . . Our history of copycat is nothing to be ashamed of,” he said. “On the contrary. Copying means learning. It means

正传

墨子是历史上唯一一个农民出身的哲学家，**墨家**创始人。在先秦时期创立了以几何学、物理学、光学为突出成就的一整套科学理论，号称是位可以囊括所有古代诺贝尔奖的人。

二千多年前墨家便已有对光学（光沿直线前进，并讨论了平面镜、凹面镜、球面镜等，尤以小孔成像出名）、数学（已科学地论述了圆的定义）、力学（提出了力和重量的关系）等自然科学的探讨。

并且，把这些理论大量变成了现实并投入实际运用，如大量的守城兵器。





Figure 2. Presentation slide: The relevance of Mozi to understand Chinese innovation.

Source: Shared with author during interview, March 2012.

you are redoing it, but in your own way. It's like learning a language. You have to write the words and sentences over and over, copying from the teacher. In the process, they learned the basic skills. After you learn the basics, you can create sentences and build grammar, and at one point you can write your own article. You can have your own style. It's a very natural process. It's nothing to be ashamed of or blamed for."

As Eric spoke, he opened his laptop computer and showed me a PowerPoint slide he had used during a talk at a Maker Faire in Europe. On one of the slides was a picture of an old drawing of a middle-aged man surrounded by mathematical instruments, sketches, and a vessel, evaporating steam (see Figure 2). "This is Mozi," he explained, "I like to explain *shanzhai* by referring to Mozi. He was a Chinese philosopher who lived thousands of years ago, around the time of Confucius. Mozi was not only a thinker, he was also a maker. He was a very independent thinker and maker. He wrote about his observations of the world, but he also conducted experiments and built things. He was not wealthy, but was extremely skilled in creating mechanical things and devices. He was resourceful and self-reliant. That's exactly the meaning of *shanzhai*."

Taken together, the references to Chinese philosophy and to China's history of copycat production alongside the implementation of new production models and businesses at DFRobot and Seeed Studio are all oriented toward unsettling dominant cultural meanings of innovation and expertise. Articulations of "innovate with China" and "hacking with Chinese characteristics" constitute an act of boundary work, aimed at carving out Chinese manufacturing as a legitimate partner in contemporary technology production and design. Technology expertise and innovation, here, is rendered as contingent on historically, socially, and economically specific processes, rather than as a global standard or inherently rooted in Western histories and cultures of hacking and computing.

Conclusion

Predominantly, making is framed as a solution to social and economic struggles in the West by enabling a return to a state of authentic, deep, and hands-on engagement with the world—one that was lost due to outsourcing of manufacturing and advances in IT. This reengagement with the machine, materials, and tools of production is envisioned to arrive in a refurbished and technologically enhanced package, enabling people to get their hands dirty in the safe confines of middle class and intellectual surrounds—the shed, the garage, the university lab, and the makerspace. It's a utopian vision rife with technological determinism that portrays software-enhanced machines as the harbingers of a third industrial revolution with "made in America" at its center (Anderson 2012). Quintessential maker tools such as 3-D printing are envisioned to democratize production, while avoiding the labor-intensive work of mass manufacturing (Söderberg 2013), elevating the maker to a "societally significant problem solver, working on behalf of the nation and the world, and within a community of makers, but still an individual who determines his or her own path" (Currie Sivek 2011). This discourse is rooted in a Western imaginary and history of technology production. Contemporary hacker and maker culture is often portrayed, for instance, as an extension of the US 1960 and 70s Internet counterculture (Douglas 2002; Turner 2006).

I have demonstrated in this article how China's makers challenged any direct mapping of a globalized narrative of innovation and Western histories of hacking onto China. I have shown that the demarcation of Chinese manufacturing from hobbyist making was aimed at rendering manufacturing as a site of expertise in technology innovation. This boundary work was performed not only through articulation in talks and writings but also

through the setup of Chinese businesses such as DFRobot and Seeed Studio. I have also shown that China's makers articulated manufacturing as a site of both technological and cultural expertise. They refute a common conception of technology production that splits manufacturing and innovation along geographic lines such that technologies are conceived and designed in the West and then manufactured in low-wage regions with loose regulatory restrictions. They refute the idea that design is a site of creativity and innovation, whereas manufacturing is only a site of its numb execution. When China's makers destabilized this common sense of what counts as site of expertise in production and design, they opened up the concept of expertise itself. Expertise in technical production and engineering (Collins and Evans 2007), they wished to emphasize, cannot be divorced from expertise in cultural production (Bourdieu 1993). Or in other words, expertise in industrial production entails not only technical know-how but also a particular cultural competency—an understanding of the social organization of *shanzhai* production and the culture and practice of open sharing applied to manufacturing.

Let me elaborate by turning, once more, to the notion of “hacking with Chinese characteristics.” “Hacking with Chinese characteristics” is a pun on the popular phrase “socialism with Chinese characteristics,” a post-Mao rhetorical strategy employed by state officials to align modernization strategies, such as the establishment of special economic zones in Shenzhen (Cartier 2002) or the increase in foreign investment, with the promotion of national autonomy, in order to modernize without being Westernized (Anagnost 1997; Ong 2006; Rofel 2007). With the notion of a “hackerspace with Chinese characteristics,” David Li made a conceptual link between hacking and China's modernization discourse. Chinese politicians use the phrase “socialism with Chinese characteristics” to render China's social, technological, and economic development in alignment with core cultural values and traditions (Greenhalgh 2011). Popular phrases like *xixue wei yong*, *zhongxue wei ti* (Western learning for function, Chinese learning for substance), which emerged at the end of the Qing dynasty, in the mid-nineteenth century (De Bary and Lufrano 1999; Jones 2011), drive home the idea that capitalism is ultimately intended to increase the power of the Chinese nation-state (Ong 2006) and that modernization is a site to renew Chinese culture (O'Connor 2012). This proposition that to “modernize” China can and should not happen without preserving its “integrity as a people and a culture” (MacFarquhar and Schoenhals 2006, 459) is emerging out of a debate that has preoccupied China since the opium war and has floundered with the dissolution of Confucianism as Chinese “essence”

(O'Connor 2012). While politicians render technological development and innovation as crucial for moving the nation forward, they also caution against Western information imperialism. What counts as “Chinese characteristic” depends on the context of use, but often refers to what might fall under the category of cultural heritage and tradition. In contemporary discourse, politicians often invoke Confucianist values and belief systems to represent what they describe as “core cultural values.” If an idea, practice, or thing is labeled “with Chinese characteristics,” it is portrayed as in line with Chinese culture and traditions. A “hackerspace with Chinese characteristics” implies that hacking and making practices are inherently Chinese, in line with China’s core cultural values, and something that Chinese people already identify with and practice. When David Li talked about building “a hackerspace with Chinese characteristics,” he envisioned a particular future for both China and the endeavor of “making” itself, one that took seriously China’s manufacturing culture as site of expertise.

The notion that China constitutes a particularly unique environment for makers has proliferated much more widely and way beyond China’s first hackerspace. Since 2012, a series of developments began to take place in the South of China, in and around the city of Shenzhen, that are both capitalizing on and expanding the vision of hacking with Chinese characteristics. As covered in great detail elsewhere (Lindtner, Hertz, and Dourish 2014; Lindtner, Greenspan, and Li 2015), numerous foreign investments, media attention, and personal accounts of successful maker start-ups that travel to Shenzhen in order to turn visions of the smart home, Internet of Things, robotics, virtual reality, and so on, into tangible products, have shaped up an image of Shenzhen as the “Silicon Valley for hardware” or “a maker’s dream city.” Shenzhen has become the place to implement the utopian visions of a new generation of makers to work again “like artisans and produce like an assembly line” (Currie Sivek 2011).

At the same time, much coverage in the West rushed to emphasize that “the Silicon Valley comparison remains aspirational” and that Shenzhen was not on par with the “San Francisco Bay Area [that] has spent decades developing a complex and near-complete innovation ecosystem” (Sheehan 2014). Familiar stories of Asian copycat production were retold both to warn enthusiastic maker entrepreneurs of the potential ramifications of betting on China (e.g., economic damage through piracy acts) and to reinforce the idea that China was not (despite the heightened attention) a place that indeed threatened Silicon Valley’s leadership in defining what counts as good innovation and quality design. Chinese manufacturing is represented as “pirate function”—as Kavita Philip developed the term—simultaneously

necessary and inconvenient for Western business, but one that will inevitably “be cleaned up with the coming of full-fledged modernity to backward nations” (Philip 2004).

As I have shown in this article, China’s makers actively work against any such simplistic readings of China’s history and contemporary culture of copycat, open manufacturing, and making-do. China did not, they argue, have to modernize or become like the West in order to innovate. In demarcating China as a site of expertise *against* maker, hacker, and engineering cultures and histories in the West, China’s makers performed a form of boundary work (Gieryn 1983); in their articulations of a Chinese ideology of hacking, David Li, Bunnie Huang, and Eric Pan, for instance, distinguish cultures and histories of making rooted in manufacturing and a making-do mentality from making cultures rooted in Western Internet counterculture (Turner 2006) and hobbyist practice. They “expand authority and expertise” (Gieryn 1983) by demonstrating that China’s culture of making can neither be understood based on Western principles of copyright and intellectual property nor on Western histories of hacking. China’s makers not only hack dominant ideologies and histories of hacking (Söderberg and Delfanti *in press*). They also demarcate Chinese manufacturing as a legitimate site of expertise and in so doing advocate expertise in technology innovation to be rooted as much in technological know-how as in historically contingent cultural modes of production.

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Notes

1. Hackerspaces are shared spaces that bring together people engaged in building creative technical projects through the sharing of equipment, tools, software, and hardware.
2. Remarks by the President in the 2013 State of the Union Address: <http://www.whitehouse.gov/the-press-office/2013/02/12/remarks-president-state-union-address>.
3. Large international corporations are also making significant investments in making, including Intel, Ford, TI, Stratasy, Disney, and the Knight Foundation. In 2012, the US military agency Defense Advanced Research Projects Agency (DARPA) dispersed funds to O'Reilly Media for an educational program aimed at "extending the maker movement into schools" (Dougherty 2012); and in 2013, Intel introduced the Arduino-compatible Galileo board, aimed at branding Intel as a champion of the maker movement.
4. In 2011, China's makers settled on the Chinese term *chuangke* (创客) to contrast their practices from illegal hacking or *heike* (黑客) in Chinese. *Chuangke* has the advantage of connoting *chuangyi* (creativity) and *chuangxin* (innovation), which are employed in positive terms in political and public discourse as a way to foster social change and technological innovation (Lindtner 2012). The English terms maker and hacker are often used interchangeably in China, though the term maker for the practitioner and hackerspace for the location are most common.
5. Official announcement of mass maker space, January 2015: <http://www.fmprc.gov.cn/ce/cohk/chn/xwdt/jzzh/t1232941.htm>.
6. *Workunit* (*danwei* 单位) refers to state-owned institutions during the cultural revolution in China. The *danwei* constituted a core organizing principle of social transformation after 1949, breaking up the large city population into smaller collectives that provided employment, housing, and social benefits for workers and their families (Lu and Perry 1997; Whyte and Parish 1984). The *danwei* contributed to a city's material and social structuring, dividing up China's large urban populations into manageable subunits. The cofounders of the coworking space did not use appropriate term *danwei* in order to remember the past or to replicate the old workunit system in the present. Rather, it was used to portray a working style that the cofounders considered radically new, and yet as something that Chinese people nevertheless do.
7. TEDx is aimed at supporting independent organizers to create a TED-like event in their own community. Accessed June 1, 2015, <https://www.ted.com/about/programs-initiatives/tedx-program>.

8. Mao believed that society will eventually overcome contemporary limits put on creative expression such as censorship and copyright law. Sharism describes that people are only temporarily held back toward reaching their natural state of connectivity.
9. Creative Commons (CC) is a nonprofit organization headquartered in Mountain View, California, devoted to expanding the range of creative works available for others to build upon legally and to share. The organization has released several copyright-licenses known as creative commons licenses free of charge to the public. These licenses allow creators to communicate which rights they reserve, and which rights they waive for the benefit of recipients or other creators.
10. Hackerspaces across to globe list their businesses on the Hackerspace Wiki: http://hackerspaces.org/wiki/List_of_ALL_Hacker_Spaces.
11. Maker Faire (<http://makerfaire.com>) is an outlet for hackerspace members to exhibit their projects, as well as a source of inspiration for the “hackerspace ethic.” Organized by the Make Magazine, the large-scale festival features hundreds of exhibitors to celebrate arts, crafts, engineering, and science projects with a Do-it-yourself (DIY) mind-set. Although Maker Faire is primarily an event located in the United States, the festival serves as a cultural meeting point and catalyst for the hackerspace community more globally through the organization of “Mini” Maker Faires in Canada, China, Chile, Scotland, the United Kingdom, Japan, Korea, Australia, Singapore, Nigeria, and the Netherlands.
12. DFRobot is a Shanghai-based open hardware producer, specializing on robotics: <http://www.dfrobot.com>.

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