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MAKING OR MAKING DO? CHALLENGING THE MYTHOLOGIES OF MAKING AND HACKING

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While scholars have critically examined the discourse that 'hacking' and 'making' are empowering practices of individualized technological production and innovation, these stories have largely retained American cultural assumptions. Drawing from fieldwork in Bangladesh, Taiwan, Vietnam, Paraguay, and China, we discuss making and hacking via alternate sociocultural histories, visions, and aspirations. We do this through the lens of 'making do': using the materials and competencies on hand to create objects or processes that aid in everyday life, with creativity and innovation countering precarity and marginalization. We intend to decenter the idea of a unified hacker/maker movement, the idea that this movement presents sites of individualized empowerment and selfrealization, and the implicit placing of both within dominant American values. We show that making and hacking can instead express more ambivalent projects, ranging from assertion of local needs and values to situated forms of coping with the depredations and displacements of a neoliberal world.

Keywords: making, hacking, mythology, ideology, ISTC, hacker culture, OLPC, Shenzhen, shanzhai, free/open-source software, FOSS, infrastructure, cosmopolitanism, marginalization, peripheries, resistance

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By Morgan G. Ames, Silvia Lindtner, Shaowen Bardzell, Jeffrey Bardzell, Lilly Nguyen, Syed Ishtiaque Ahmed, Nusrat Jahan, Steven J. Jackson, Paul Dourish

INTRODUCTION

A common mythology amongst 'hackers' paints them as self-reliant renegades who, like the equally-mythic cowboys of the American West, employ a mix of determination and technological prowess to tame a new frontier. Much has been written to overturn this one-sided view in order to demonstrate that hacker culture is in fact deeply indebted to the American techno-political landscape of the Cold War (Edwards 1997; Turner 2006). Yet, the hacker's revolutionary imaginary continues to inspire contemporary understandings of hacker culture (Levy 1984; Thomas 2002; Coleman 2014). Likewise, 'making' has been widely promoted as an empowering practice of individualized technological production and innovation (e.g. Anderson 2014; Johnson 2014). Applying visions of hacker culture (particularly its expression in the open source software movement) to the design of hardware, many advocates of the 'maker movement' believe that principles of open sharing, peer production, and hands-on tinkering are central to the future of economic, social, and technological development (Sivek 2014; Anderson 2014). Stories about making and hacking often share a largely American-centric revolutionary rhetoric, one that portrays technological know-how and craftiness as crucial in liberating individuals from corporate monopolies and bureaucratic state structures. "If you can't hack it, you don't own it" is a phrase commonly used in both circles to articulate this notion that technological making and hacking empower individuals to fight the establishment.

This paper introduces stories of making and hacking rooted in alternate sociocultural histories, visions

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and aspirations. Drawing from fieldwork in Bangladesh, Taiwan, Vietnam, Paraguay, and China, we discuss values, visions and practices that do not neatly fit the Western-centric metanarrative of the maker or hacker as countercultural revolutionary. While revolutionary ideals of making and hacking sometimes figured in our sites, they were simultaneously reworked and often challenged as people attempted to situate their work both locally and in relation to global networks of technology production. Grounded in our sites and specific engagements, we see making and hacking through the lens of 'making do.' By *making do*, we underscore the pragmatic situatedness within the constraints of everyday life, where creativity and innovation rub against precarity and marginalization.

We find that practices of 'making do' constitute a constructive alternative framing to the dominant discourses of innovation and creativity that surrounds contemporary visions of making and hacking. While these practices are sometimes tinged with longing for cosmopolitan futures or aspirations for a better life, we suggest that maker and hacker practices can be better understood as using the materials and competencies on hand to create objects or processes that aid in everyday life. The ethnographic sites that we present discuss practices of making and hacking as 'making do' in Dhaka, Bangladesh; Taipei, Taiwan; Hanoi, Vietnam; Asunción, Paraguay; and Shenzhen, China. Although we engage with non-Western making and hacking, 'making do' certainly also applies to Western making and hacking, as we will outline in this paper. We wish to emphasize here that we do not inherently equate 'making do' with the subaltern or so-called non-Western world. On the contrary, we attempt to tease out how across class, cultural specifics, and local contingencies, hacking and making unfold as 'making do' in relation to globalized processes of technology production.

In Dhaka, Syed Ishtiaque Ahmed, Nusrat Jahan, and Steven Jackson found deep entanglements between practices of making and infrastructure (or lack thereof) as residents of an informal settlement cobbled together unofficial links to surrounding services in the face of constant precarity. In Taipei, Shaowen Bardzell and Jeffrey Bardzell describe how another informal settlement was displaced even as the city government used the neighborhood's homes and culture in order to celebrate the "maker movement." In Hanoi, Lilly Nguyen details the complex relationship between logics of production and reproduction in a group of local 'hackers' promoting open-source software. In Asunción, Morgan G. Ames found that a similar tension existed among a local hacker group who felt the pull toward outward-facing cosmopolitanism even as they attempted to create a "made in Paraguay" ethic among up-and-coming programmers. Finally, Silvia Lindtner describes how Shenzhen, a manufacturing city in the South of China, is in the process of being remade as a central hub in global circuits of making and technology innovation. Taken together, these cases highlight themes of precarity and exclusion from global discourses on the one hand, and themes of nationalism, resilience, and at times hope on the other.

These cases destabilize several aspects of dominant visions of making and hacking. First is the idea that making and hacking are tied exclusively to Western histories of Internet culture and to political and social concerns central to Western knowledge economies. Drawing from sites around the world, our research shows that rather than there being a unified global maker/hacker movement, these practices are diverse and situated, entangled simultaneously with local, national, and global processes. Second is the idea that making and hacking are sources of individualized revolution, echoing New Communalist notions of the utopian potential to withdraw into groups of like-minded peers rather than engage with larger sociopolitical apparatus (Turner 2006). The entanglements of agency and precarity throughout our cases present a very different social and political sensibility motivating these practices. Third is the implicit notion that making and hacking echo the socioeconomic stability and market orientation of

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middle-class sensibilities and values, with scrappy entrepreneurs overcoming odds and collecting TED-worthy wisdom along the way (Kuriyan, Ray, and Toyama 2008; Negroponte 2006). By showcasing the wide variety of activities that can fit under the rubric of 'making' and 'hacking,' we assert that beyond their heroic narratives of empowerment and self-realization, making and hacking can express other and more ambivalent projects, ranging from assertion of local needs and values to situated forms of coping with the depredations and displacements of a neoliberal world.

BACKGROUND

This paper builds on prior work that provides alternative accounts to dominant stories and visions hacking and making. Ames et al. (2014) question the claim that making, hacking, and DIY contributes to the democratization of technology innovation, suggesting that what counts as making in research and popular media is closely aligned with a combination of middle class privilege and corporate interests. Lindtner, Greenspan, and Li (2015) challenge the dominant vision that maker and digital fabrication tools will single-handedly revamp the creative economy into a manufacturing-centric innovation age. Toombs, Bardzell, and Bardzell (2015) use feminist care ethics as a wedge to reveal discrepancies between U.S.-based maker self-descriptions, characteristically articulated in terms of libertarian self-empowerment and individualism, and the powerful undercurrents of community maintenance manifested in hundreds of acts of care performed by makers. Similarly, Roedl, Bardzell, and Bardzell (2015) challenge the common claim that making has high potential for sustainable IT by demonstrating the substantial technical, legal, and political barriers makers face, and arguing that there is little research to suggest that makers actually have to the capabilities to overcome them.

Our work together began in 2012, when Intel Corporation funded the Intel Science and Technology Center for Social Computing (ISTC-Social) with the charge to conduct both empirical and theoretical work around emerging practices at the nexus of technology and culture. One of ISTC-Social's research themes identified early on was the cultural and collaborative practices around making, hacking, creativity, do-it-yourself (DIY), repair work, and other forms of hands-on technology production. As a group of both industrial and academic researchers, we were interested in the way that apparently "new" modes of technological production were a site for the articulation of rhetorics of innovation and a specifically "digital" way of re-encountering production logics.

Interestingly, in the earliest discussions about the Center's research activities, the Maker movement was dismissed by some in Intel as embodying a set of amateurish and hobbyist perspectives that were at odds with the images of industrial reliability and professional expertise that Intel sought to project. Before long, though, Intel began publicly endorsing 'making' by providing funding for maker-related activities. In the fall of 2013, CEO Brian Krzanich introduced the Galileo Board, an "Intel inside" and Arduino-compatible microcontroller platform, aimed at branding Intel as a champion of the maker movement (Johnson 2014). Intel discussed the growing importance of making to the company in a December 2014 special issue of IEEE's *Computer* magazine, co-edited by a group of Intel researchers. Its introduction recounts the story of Krzanich's home-made fire pit to demonstrate that the "making" ethos extends throughout the corporation (Johnson 2014).

This change of heart came as other corporations, from Google to Ford, approached the increasing hype around the maker movement as an opportunity to open up new markets and revamp broken economies and educational systems, borrowing both people and rhetoric (Ames and Rosner 2014) from the decades-older 'hacker' movement (Levy 1984; Thomas 2002). For instance, in his 2013 State of the Union Address, US President Barack Obama lauded 3D printing and related maker tools and approaches as enablers in the revamp of the American manufacturing industry to

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guarantee "that the next revolution in manufacturing is made in America." The Shanghai Division of the Chinese government similarly endorsed making starting in 2011, funding the construction of 100 makerspaces as so-called "innovation houses" (Lindtner, Hertz, and Dourish 2014).This constituted a particularly opportune moment for us to study in depth what motivated stakeholders as diverse as Intel, local and national governments, policy makers, and passionate geeks to get on board with making and endorse it as an enabler of personal fulfillment, education, and economic and social change. As we will tease out in this paper, we began to see how making and hacking were less about these kinds of radical transformations and more sites for 'making do' without challenging larger institutional changes and neoliberal structures of capitalism, production, and investment.

Our emergent framing of 'making do' reflects a fundamental commitment that our various projects have made to interpret making/hacking as multiply situated – geographically, economically, politically, materially, and historically. An engagement with making or hacking, wherever and however it happens, does not arise out of nowhere, and to the extent that maker/hacker practice embodies particular approaches towards expertise, materials, community, and cycles of consumption, it does so in ways that are specific to each locale in which it is enacted. What we see across our cases below is that despite our sites' varying positions with regards to access to global networks of finance and resources, they all displayed a form of "coping," a making-do mentality not just towards technology production, but life and work writ large. While this plays out in a variety of ways, none conform to the utopianism or individualized revolution as characterized by the maker and hacker mythology.

The bulk of this paper focuses on our five cases, each drafted by the researcher(s) who conducted the fieldwork described. The order of the papers represents a narrative continuum from marginalization to centrality in global hubs of technoculture. The first two cases about Bangladesh and Taiwan describe the powerful dynamics of dispossession for those along the very margins of the neoliberal order. The following cases of Vietnam and Paraguay reveal the dialectics of cosmopolitanism and localism as new technological sites find themselves in closer proximity to global techno-culture. Lastly, the case of China shows the changes to hacking and making ideologies as new geographies assert their centrality. We conclude with a theoretical discussion of the common themes across all of our cases.

METHODS

While we have conducted our fieldwork independently – each case below will state the authors who were involved – we share an anthropological methodology and a critical-historical orientation in interpretation. As such, we embrace our own reflexive position as ethnographer-participants in our fieldsites, and the narrative reflects this positionality, at times referring to the researcher involved with that case specifically. At each site, the authors conducted ethnographic research that included full-time, immersive participant observation and dozens of in situ interviews across several months (18 months in Bangladesh, several months and counting in Taiwan, several months in Vietnam, seven months in Paraguay, and several years and counting in Shenzhen). All data were collected in compliance with the authors' respective institutional review boards. Initial case-specific analysis was done by the respective researchers, using grounded theory techniques for the reflexive analysis of ethnographic data that are standard in anthropology.

The common themes we discovered across our sites were borne from discussions among ISTC participants about the dimensions of 'making' in each of our fieldsites and what they might tell us about the 'maker movement' more broadly. We quickly realized that all of our narratives troubled the utopian mythology of 'making' in some way, and we used this as a lens to each revisit our own

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fieldnotes and interview transcripts to explore this theme more deeply in each of our sites. This integrative method – of finding common threads across individual 'cases' and using these common threads to reflect on broader social theories – fits with the 'extended case method' (Burawoy 1998). In addition to providing a robust 'reflexive' framework as an alternative to the demands of 'positivist' science – demands that are incompatible with reflexivity – the extended case method provides a means to integrate the grounded and specific findings in each case into broader patterns of social life and social change – in our case, to reflect on the multifaceted practices of 'making' and 'hacking' across the Global South as a way to trouble the hegemony of the 'California Ideology' and other Silicon Valley-centered narratives.

HACKING INFRASTRUCTURE: DISPOSSESSION, RESISTANCE, AND ENGAGEMENT IN URBAN BANGLADESH

Our first case works toward visions of making that take seriously their engagement with settled worlds of infrastructure, power and inequality, including in their rawest and most brutal form. Over 18 months, authors Syed Ahmed, Nusrat Jahan, and Steven Jackson worked with residents of the South Begunbari neighborhood, a low-income residential area of downtown Dhaka, Bangladesh within the wider Tejgaon industrial district that houses many of the populations serving more affluent parts of the urban core. Like similar districts around the world, large parts of South Begunbari are not supposed to exist. They hold no security in the eyes of the state for whom the area and its residents are, simply, illegal. This precarity is matched in the life experience of its residents, the vast majority of whom have gone through repeated experiences of displacement and resettlement, whether of the rural-to-urban variety widely prevalent in Bangladesh today, or via forcible and/or economic eviction from other urban areas. Many of them face eviction yet again as parts of the neighborhood are bulldozed to make way for the Hatirjheel Waterfront Development Project, set to remake the urban infrastructure and experience of Dhaka through new transport arteries, flood control, waterfront reclamation, and green space development.[1]

What does it mean to 'make' or to 'hack' – and to hack *infrastructure* – in an environment such as this? As a largely illegal settlement, South Begunbari is not supposed to have infrastructure at all, at least of the forms central to the modern infrastructural ideal: electricity, water, sewage, and road networks (Graham and Marvin 2001). But as an island in an adjacent sea of higher status and more formally recognized entities, infrastructure surrounds and permeates South Begunbari. Roads and power lines crucial to the urban grid transect the area. Drainage and sewer mains central to urban flood control and water purification run throughout. As most of these systems offer no formal entree or on-roads to the residents of Begunbari themselves, these residents do what might be expected, connecting to extant infrastructures through a variety of hacks, taps, and fixes. Cheap plastic pipes run overhead and underfoot, bringing water and sewage back and forth between households and the formal government lines. Electrical lines run up, along, between, and through buildings, forming a jerry-rigged network to which almost all of the local residents are connected, and which registers in the official system as unaccounted-for drains and losses. Much of this work is done collaboratively, making extensive use of a homegrown cohort of electricians, plumbers, carpenters and builders. Their skills largely derive from work in the more formal infrastructure sector – including even the large-scale development projects that have periodically threatened South Begunbari and similar areas with displacement. To walk through South Begunbari today is to see infrastructure on display, in ways set apart from both the oft-noted 'invisibility' of infrastructure (Star and Ruhleder 1995) and its more symbolic and/or performative dimensions (Larkin 2013).

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The richness and ingenuity of this work is attested to both by its effectiveness – South Begunbari functions well using these informal arrangements, hacks, and workarounds – and by the robustness of the informal infrastructure sector, which constitutes one of the most important and reliable economic engines of the neighborhood. Viewed in its most positive light, this is a story of creative technical engagement that goes some (if small) way towards softening the stark lines of infrastructural exclusion otherwise in force here. This may not be hacking or making in its most typical or pristine form – at least as measured against the types of hacking discourses that tend to dominate Silicon Valley-type celebrations of the same – but it may in fact be hacking in one of its more consequential and globally common forms. For the same reason, it is probably also a story of under-valorized innovation, and another argument for why western-centered discourses of innovation really ought to get out more often.

But it is no less the case that this creative technical engagement proceeds from a place of vulnerability, not strength. These hacks remain light and fragile creatures, subject to all kinds of limits, reversals and breakdowns. The cheap plastic pipes often leak and break, and water and sewage periodically overflows onto the street. The voltage of the electricity fluctuates abruptly, and unpredictable and sometimes extended power outages characterize life in the area. And complaints from nearby legal residents often bring officials to check the lines and demand the disconnection and dismantling of illegal connections.

More broadly, while these hacks and fixes may help extend the reach of infrastructure or blunt the sharp edge of its exclusion, at the end of the day they do little to change the underlying conditions of marginality and disempowerment from which infrastructural exclusions flow. For this reason, they live more comfortably in the pragmatic languages of ‘coping’ and ‘making do’ than in more heroic notions of alternatives or resistance that are sometimes (if erroneously) assigned to such sites. If ‘making,’ this is making under (severe!) constraint. If hacking, it’s hacking without heroism. If infrastructures, they are infrastructures without standing – and all the vulnerability and precariousness that lack of standing implies.

MAKING THE DISPOSSESSED IN TAIWAN

Building on the same marginalized kinds of ‘making’ as featured in the first case, our second case, drawing on ongoing work by authors Shaowen and Jeffrey Bardzell, further articulates a site of tension between a decades-old instance of making-as-coping and the recently recognized and celebrated “Maker Movement” in Taiwan, showing how a valorization of the latter led to the dispossession of the former. At the conclusion of the Civil War in China in 1949, several dozen Kuomingtang soldiers who fled to Taiwan established an off-the-grid commune called Treasure Hill in the outskirts of Taipei beside a water utility plant. Over the years, they attracted a number of workers from the water plant to live there as well. Using natural and reclaimed materials, they built a few hundred small houses, (illegally) piped in water from the water utility plant, farmed the land for vegetables, and kept pigs. Over several decades, they grew until there were more than 500 individuals in over 200 households in the community in 1991.

In many ways, Treasure Hill is similar to South Begunbari, in that the community was largely invisible and dependent on creative hacks to tap into city infrastructure, with similar disruptions of service and breakdowns faced by residents of South Begunbari. But Treasure Hill also differs in two key ways: first is that the village, located on the backside of a steep hill facing away from the city, gradually became swallowed up by the city, and its real estate value went from negligible to significant. Second, and presumably related to the first, is that the Taipei City Government decided to intervene – not merely to make the residents disconnect their

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illegal taps, but to renovate the village, bringing it up to code, and reincorporating it into the city.

The initial idea had much to recommend it. Couched in the "Creative Taiwan" cultural creative industries policy initiative, Treasure Hill not only would be brought to modern building and safety standards (crucial for a hillside community in a country subject to major earthquakes and typhoons), but it would also be integrated sustainably into Taipei's economy. The idea was to create a "Symbiotic Art Settlement," bringing together the poor residents of Treasure Hill with young and rising artists. Treasure Hill would be an urban park, a tourist attraction, creating opportunities for makers, artists, and residents alike. It was to be a grand experiment in "urban acupuncture" – a carefully targeted intervention designed to improve the economic and cultural health of the city in a focused and skillful act of urban healing.

But between the initial planning and the eventual execution of the renovation years later, this optimistic vision became a much less pleasant actuality. Two issues in particular made implementation more difficult than anticipated: first, the policy environment shifted, and the Treasure Hill renovation was now subject to a new policy framework. Second, the government overestimated the number of residents who would be willing to relocate, which led to serious frictions between government and residents, including sometimes violent protests and the eventual forced dispossession of many of the residents. Today, Treasure Hill is indeed an urban park and tourist attraction. It hosts Taipei OpenLab, one of the most conspicuous and successful maker spaces in the country. But for the new makers to move in, the old "squatters" – whose making included hundreds of houses, a utility system, a farm system, and much more – had to be moved out.

We read this case as a government policy implementation intended to develop the economy by democratizing technology innovation through, among other things, maker labs in artist villages, themselves renovated as tourist sites, bringing consumers directly to the makers and artists. It reveals some of the sociopolitical costs and ironies involved in policy initiatives intended to support making.

We begin by focusing on the link between supporting making and dispossession. Anthropologist Athena Athanasiou argues that dispossession refers to "processes and ideologies by which persons are disowned and abjected by normative and normalizing powers that define cultural intelligibility and that regulate the distribution of vulnerability" (Butler and Athanasiou 2013). In the case of Treasure Hill, the initial intentions of the government were to create a symbiotic society in which its impoverished residents would not be dispossessed, but would stay in Treasure Hill. The intention was to incorporate – in multiple senses – this village back into the city: physically, socially, economically, and infrastructurally. The original plans to create this symbiotic community would have been among the first urban experiments of its kind in the world (Wang 2010; Chang 2004). However, the government committed to the project without the buy-in of residents it needed to proceed, and changing politics and budgetary constraints appear to have decreased the benefits of the renovation, worsening its situation with the residents. For example, government promises to locate residents in public housing turned sour when residents felt that the public housing was worse than the housing they built for themselves on Treasure Hill; that they would be separated from one another, breaking up the community; and when those eligible for the public housing turned out to be fewer than the number that the government needed to move out.

The precursor to this physical dispossession was a set of discursive moves by city planners that re-construed the residents into a new, and disempowered, subject position. For the many veterans living on Treasure Hill, their living bodies transitioned during this period from "war heroes" and "community members" to "squatters" and

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thence to "welfare recipients," depending on how the space was construed as a place (i.e., a community-settlement, a derelict structure needing intervention, and finally a cultural park). Once re-construed as squatters, the residents were subject to government authority, paving the way for their physical removal from the site and eventual conversion into welfare recipients, living in government housing for the poor.

Another way the government discursively contained residents (intentionally or not) was to create a policy narrative around the creative economy and urban renewal, guided by a set of principles, institutions, and procedures that structurally disabled the articulation of those residents who were seen as irrelevant to this economy. In this particular case, their voices were heard anyway, thanks to protests and press coverage, the involvement of non-governmental organizations, and the work of academics in the Graduate Institute of Building and Planning at National Taiwan University. Once heard, residents' voices offered a powerful counter-narrative to the city government narrative, revealing gaps and confounds in the city's narrative.

The residents' counter-narrative showed that what counted as *making* must operate inside the dominant socioeconomic system in order to *be* making. That is, otherwise indiscernible acts of creativity and value creation were treated in radically different ways – one is valorized and invested in, while the other is dismantled and removed – in spite of the fact that both sets of "makers" worked with local materials, actively sought to build community through making, contributed towards the increasing real estate value of the land, creatively innovated new designs, and oriented themselves in service of Taiwan.

One odd consequence is that the residents, by being dispossessed of their homes on Treasure Hill and moved to "legitimate" housing, had their citizenship "regained" – at the cost of starting at the bottom rung of society, but nevertheless *within* society. That is, through this process they were "made" into citizens. This adds an interesting wrinkle to dispossession theory: in the quote above, Athanasiou wrote that the dispossessed are "abjected," and while that happened here, it was not the whole story. The "abject" refers to parts of ourselves that are no longer "ours" – sweat, urine, and even corpses after death – which commonly repel us. It is easy enough to see how the residents became abjected as Treasure Hill became redefined from derelict slum to cultural park, and indeed they were expelled from the site during its transformation. But their reincorporation into society as (poor) citizens in housing projects suggests that they were not merely abject from the point of view of the government.

Technological change is often celebrated, seen as a sign of progress. Yet such change is often predicated on doing away with older ways of life. The Treasure Hill renovation project dramatized this dynamic in an especially visible way. But it also calls attention to ways that technological change can also be seen as *contiguous* with the past. Here we refer to the similarities between the "making" of the vaunted "maker movement" motivating some of these policy initiatives and the "making" that people have always done through 'making do' with available materials as part of everyday life. In this case, the "maker movement" seems to play both ways, posing as a revolutionary new paradigm of computing on the one hand, while fortifying its practices with skills and ways of life from the past. Unfortunately, as Treasure Hill shows, this discursive double-move has all too real body consequences, as the old residents of Treasure Hill not only lost their homes but also lost their status as makers.

REPRODUCTIVE LOGICS OF FREE/OPEN SOURCE SOFTWARE IN VIETNAM

Our third case turns to how the logics of 'hacking,' upon which the logics of 'making' draw, are understood in a free/open source software community in Hanoi, Vietnam, based on the ongoing

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research of author Lilly Nguyen. In place of the logics of software 'production' (focused contributing code to the global free/open source software movement), it finds that the evangelism and translation within Vietnam that this group engaged in could be better understood using logics of *re*production, with elements of masculinized national pride on the one hand and global yearning and marginalization on the other.

The ethnographic fieldwork featured here took place between 2009 and 2011, and consisted of participation observation through attending meetings, organizing workshops and events, working on translations of free/open source software applications such as Ubuntu, Fedora, and Firefox, and socializing and "hanging out" with this community of geeks. Lilly wanted to better understand the larger social and cultural work that was taking place through the technical practices of producing free/open source software.

To Lilly's surprise, her initial assumptions and interest in software *production* required immediate reconsideration when she very quickly discovered that the primary activities that brought this community together were evangelizing and translation. Both evangelism and translation were decidedly *non-technical* practices and, at first blush, their socio-cultural qualities appeared to conform to *reproductive* logics; that is, of "merely" transferring free/open source software from English into Vietnamese. In fact, this distinction of contributing new code as the ur-labor of free/open source software was held by many of the Vietnamese free/open source software enthusiasts she met who one day hoped to be able to "contribute back to the international community." For now however, this community was focused primarily on bringing free/open source software *into* Vietnam.

How then were we to make sense of these lowly regarded practices? For this community of men (and they were all male), their goals for free/open source software was primarily oriented around establishing a *national* community. These men saw themselves as representing Vietnam among the wider international community of free/open source software advocates. In turn, these men saw themselves as leaders and created a culture of parochial masculinity around these technical artifacts. The aesthetics of leadership coincided with the gravitas of politicality, given the heavy-handed history and monopoly of the Communist Party on all things labeled "politics." As such, these men were motivated by the prospect of social recognition at home, access to new ideas and the English-speaking world, and most importantly to the validation and legitimacy such access conferred. It is within this cultural-discursive-aesthetic environment in which evangelism and translation made sense for these men.

As a distinct rhetorical practice, *evangelism* allowed these software advocates to enact their positions as moral leaders. Evangelism aspires to impact, to change in action, and to ultimately convert new followers. The work of organizing meetings and conferences, of preparing talks and demos was done with the intent of promoting free/open source software in the hopes of bringing the good word to a broader and unknowing Vietnamese public. Moreover, this evangelism conformed to scripts and roles of masculine authoritative leadership. One particular quality of this aesthetics of authoritative leadership was a strident moralism. When Lilly initially met Long, she was very impressed by his politeness. As a young man in his early 20s, Long was looking to find his way in the world. As Long and Lilly worked together on various free/open sources software projects, this moralism became much more apparent and served as the primary lens in which he saw the world.

Our work together consisted of planning and giving a talk on the One Laptop per Child project in Vietnam. We disagreed sharply on the tone of the talk. Long insisted that we had to outline a clear-cut strategy for implementation and success. While my impulse was to speak in less strident terms, Long had a different idea. Sitting in the air-conditioned computer lab at the local university, Long spoke

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quickly and vigorously, insisting that what the project needed was a centralized group who would be responsible for localizing the project in its entirety. We debated this for several minutes.

What became clear as we spoke was his insistence on a vision of teleological success that was singularly defined. Long was convinced that without a central group directing and organizing, the project would most certainly fail. As an aspiring advocate, Long felt that it was his job to provide a face of expertise and success. Long's aesthetic judgment conformed to the rhetorical habits of the larger Vietnamese free/open source software community. Like the other software evangelists, Long aspired to become a leader and an authoritative figure in the community. He very quickly learned to speak in the same fashion as the older men.

In addition to evangelism, *translation* was a vital practice for this community. Translation was important to provide Vietnamese-language software for the majority of non-English speaking Vietnamese people. Like other technological evangelists, these men aimed to generate public awareness of free/open source software through translation in the hopes of growing a community of users. As the focus of their attention and time, prioritizing translation made sense to the moral purpose of nation and freedom.

However, the work of translation was problematic in that it did little to render the Vietnamese free/open source software community visible to the global community of free/open source software geeks. Free/open source software advocates regularly repeated the term 'success' in a future tense that clearly indicated a concern with lagging behind the rest of the world. During their public talks, evangelists oscillated between confident performances of teleological success with bold statements like, "Free/open source software in Vietnam *will* be a success!" to more ambivalent discussions of the challenges to free/open source software in terms of competing with unlicensed software and public unfamiliarity. The language of success reflected a deep-seated anxiety for validation and recognition from the broader global community, though such recognition remained evasive.

Though they identified with the rhetoric, values, and identities of the global free/open source software communities they interacted with online and occasionally met in person, many of the Vietnamese participants saw themselves as separate from the English-speaking open source community, unseen and unappreciated. And neither evangelism nor translation brought these 'geeks' the global recognition they sought. Both practices served to transform this group of men into distinctly national socio-technical leaders (moral technological leaders), but kept them invisible to the global community. This lack of recognition was exemplified by an American free/open source software developer who visited Vietnam during my fieldwork. This man worked for a notable free/open source software company and happened to visit Vietnam for a vacation. When Lilly asked him if his company had any specific interest in the Vietnamese free/open source software community, he flatly said no and explained, "They don't contribute new code." Here, the logics of *production* that defined his own American-centric worldview of free/open source software served to reinforce the marginalization of those doing work for the free/open source software community, but in ways that were not recognized as 'valid' by him.

In conclusion, we want to articulate some questions this research raises. How can one reconcile the conundrum that these men face: their desire for global recognition and yet their attention and preoccupation with practices that render them invisible to these communities and therefore incapable of such validation? More broadly, what vision of 'local' is being presented here, and what is at stake? As this account illustrates, technologies like free/open source software, though claiming to transcend culture, clearly shape how people negotiate their cultural differences. We have seen that the free/open source software movement can

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'other' in a way that only allows for two options: either to overcome one's locality to be able to speak for all (through contributing code), or to speak only from your located position, but one that is devalued. This binary construction is certainly not unique to free/open source software, but symptomatic of a much larger problematic condition of cultural difference in the supposed "post-racial" era we live in.

THE TENSIONS OF HACKER COSMOPOLITANISM IN PARAGUAY

This case draws on ethnographic engagements with programmers and students in Paraguay to explore the ways in which hacker imaginaries emerge at the intersection of entrepreneurial practice, language politics, innovation discourse, and national reform. Through seven months of fieldwork with a One Laptop per Child (OLPC) project in Paraguay in 2010 and 2013, author Morgan G. Ames found that the self-identified hackers involved with the project – as programmers, teachers, evangelists, or students – often navigated a tension between cosmopolitanism and local engagement, seeking to legitimate their work in relation to hacker circles in the United States on the one hand, but wanting to demonstrate the uniqueness of their approaches on the other.

As detailed in (Ames 2014, 2016, 2019), Paraguay's OLPC project started strong in 2008, when two young Paraguayans secured funding from a variety of sources to bring OLPC's "XO" laptops to Caacupé, a provincial town of 43,000 about 50km east of the capital Asunción. Under the banner of "Paraguay Educa," they distributed 4000 laptops to all students and teachers in ten schools in Caacupé in spring 2009, and another 6000 to all students and teachers in the remaining 36 schools in the area in spring 2011. They invested heavily in social and physical infrastructure, most notably full-time teacher trainers in every school to promote laptop use in the classroom, and were celebrated as one of the most successful OLPC projects. But the project all but died when they were unable to secure adequate funding past 2012, downsizing to a skeleton staff and discontinuing most of their initiatives.

One of the founders, Raúl, was a skilled and hard-working programmer – and, Morgan was told, grandson of a prominent Paraguayan politician. He recruited Martin, an equally-skilled friend from his alma mater, a private Catholic university in Asunción, to do software development for Paraguay Educa in the early days of the non-profit organization's work. The two were among only a handful to contribute code 'upstream' to the main software build. Illustrating the inherent 'making-do' nature of software development as a practice, they tested new software builds on a sixth-grade class in Caacupé. They filed and fixed bugs and added features that the Boston-based development team did not think of, not being in the 'field' themselves: among other contributions, they developed a comprehensive open-source inventory system to track laptops and repairs (https://github.com/tchx84/olpc-inventario), which has been used in other OLPC projects.

Though South American programming and open-source communities had been gaining strength and visibility for some time (Takhteyev 2012; Chan 2014), Raúl and Martin's contributions attracted the attention of OLPC developers and the international hacker community, some of whom spent time with them in Paraguay. First, Daniel Drake, a British hacker who had just left OLPC as the organization fell apart from infighting, volunteered for Paraguay Educa for six months in 2009, programming with Raúl and Martin and taking intensive Spanish lessons. He was followed by a nine-month volunteering stint by Italian-born hacker and former OLPC employee Bernie Innocenti in 2010, overlapping my fieldwork. Finally, Walter Bender, OLPC's former President of Software and Content who had left to independently develop the laptop's software in 2008, made several brief visits as well, one during my 2010 fieldwork.

Though Raúl and Martin were skilled software

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developers, we attribute this attention to more than the quality of their code. What was remarkable about these two programmers was how similar they were in interests and lifestyle to programmers in Silicon Valley, where Morgan has lived since 1999. In addition for their passion for One Laptop per Child and open-source software, they loved watching anime and made nerdy technical jokes. They referred to one another by their online handles ('rgs,' 'tincho'). Their pseudo-apolitical technical worldview, epitomized by the "Hacker Ethic" (Thomas 2002), was immediately legible to Morgan, a former programmer whose social circles remained programmer-heavy. As part of the cosmopolitan elite in Asunción accustomed to global travel – and proficient English-speakers – Raúl and Martin studied and worked in Europe after their stints with Paraguay Educa. Raúl then moved to Silicon Valley to work for Facebook and Twitter, and Martin returned to Asunción to contribute to OLPC's software and mentor students through Google Summer of Code.

This group also attracted the attention of students in Caacupé, who were otherwise excluded from the well-connected and powerful circles in the capital in which the founders ran. In 2010, less than ten percent of Caacupé residents had computers (though most had television), and the most common employment by far was subsistence farming. A small subset of students (numbering perhaps one dozen, all male but one) who were eager to please these powerful figures found this contact with Asunción's elite and international visitors exhilarating. Based on their experiences, many of them said they aspired to be 'hackers' themselves, pinning onto this imaginary less the specific politics of free software or the Hacker Ethic – which were largely outside of their experiences and concerns – and more a pathway to travel, financial security, or societal enrichment. At the same time, they lacked the resources to pay for education or find employment outside of their provincial town. Though OLPC and Paraguay Educa told these students that all they needed was to work hard, this ignored the intensely hard labor that many in the town did every day, with no betterment in their prospects. In short, they both vastly underestimated the structural and societal obstacles in the way of a future in 'hacking' for these students.

One precocious family epitomized both this potential and these limitations. When Morgan met them, the elder son and daughter, in seventh and sixth grades respectively, showed her the video game they were programming in Scratch. Their mother's perceptive comments about laptops, media, learning, and child development suggested a home culture rich in critical thinking, and she was one of the most ardent boosters of the laptop program. However, she was too embarrassed of her house, which she said was only half-built, to let Morgan interview them at home. She showed her pictures of exposed rebar where walls were meant to go up, of rickety bunk beds where her children slept (and where one of the family's beloved OLPC laptops accidentally met its demise). While she hoped for the best for her children and let them believe the mythology that hard work could lead to cosmopolitan hacker futures, she confessed that she suspected that they would follow in her footsteps: a local teacher, with five children by her thirtieth birthday, who routinely worked twelve-hour days. To her, the laptops and critical thinking were not means to a better life but ends in themselves, a way of 'making do' with the circumstances they found themselves in.

The consequences of this marginalization, and the shallowness of the recommendations to overcome it, was particularly salient at a programming competition Morgan observed in November 2013. The two teams from Caacupé were the only ones from public schools and the only ones from outside Asunción. Though the students had arisen at 4am to take public buses to the capital, they were buoyant, talking about how they would leverage their first-prize trip to California into jobs in the States and prospects for their families. Morgan's hopes for them were much more subdued, as she had been watching them struggle to spell basic Python commands like "print" and "input" in English for several weeks. Their mentors waited outside during

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the competition itself, then joined the competitors upstairs for some talks while the winners were determined.

Several Paraguayan entrepreneurs spoke about their apps and gave advice while we waited. Much of it boiled down to "Learn English," as not only the programming cultures visible in Latin America but most programming languages themselves were Anglo-centric (and, indeed, Morgan had seen first-hand how much of a handicap not knowing English was for programming in Python). At the same time, they celebrated the submissions that Paraguayan programmers had made to regional app contests. Assuming that all in the room were from elite backgrounds like they were, they spoke of leveraging private school educations into strong SAT scores, and strong SAT scores into college in the United States or Europe. Nobody mentioned the many barriers – financial, social, gendered – that might be in the way (nor did the Caacupé teams feel at all strange that their teams had no girls). When results were announced, it was one of the private school teams who came in first – the team that had won the previous year.

This account points to a multifaceted 'hacker' identity in Paraguay, yet still one that is deeply influenced by privilege, infrastructure, and proximity to cosmopolitan cores and international networks. While anthropology has deconstructed notions of center and periphery (Rouse, n.d.; Vessuri 1987), the technological elite in Paraguay re-inscribed their centrality and the peripherality of those they were helping through their project. Telling, too, was how Paraguay Educa othered those they were helping. They were proudly Paraguayan, but the Paraguay they lived in – with full-time staff and manicured gardens behind glass-topped fences – was a world apart. While they were passionate about the project and wanted to do good in the world, they gossiped about children's unwashed faces and lack of shoes, or the trash along the sides of streets in a town with no garbage service. They thought nothing of pulling children out of school or of interrupting classroom time for photo opportunities.

THE SHENZHEN IDEOLOGY

All four of the cases above have discussed how making and hacking practices may be marginalized in various ways, whether locally, globally, or both. Our fifth and final case turns to author Silvia Lindtner's ongoing work in Shenzhen, China, which in recent decades has shifted from a marginal position to the center of global electronics manufacturing. At the heart of this shift is the highly successful manufacturing culture of *shanzhai* (□□), which is fundamentally a culture of 'making do,' even as others attempt to overlay more utopian imaginaries on it. Drawing from long-term ethnographic research about making, hacking and manufacturing in China since 2010, Silvia explores this remake of the city of Shenzhen once known as a site of cheap and low quality production as the new "Silicon Valley for Hardware." Since 2012, with collaborators at Hacked Matter (www.hackedmatter.com), she set out to study the various cultures of making and entrepreneurship that intersect in the South of China. She found that what attracts hardware enthusiasts and corporate investors to Shenzhen is a unique manufacturing culture that in many ways shares the values and principles of open source hardware enthusiasts, but differs in its mentality of 'making do' – making and hacking out of necessity, without the ideological trappings of freedom or empowerment often discussed in the West.

In 1979 the Chinese government declared Shenzhen a Special Economic Zone (SEZ). Coinciding with the outsourcing boom in the West, Shenzhen's SEZ status attracted foreign companies to open up manufacturing facilities in the South of China. Over the years, these manufacturing facilities grew in size and number, and in the shadows of large-scale contract manufacturers emerged a dense web of manufacturing businesses, catering towards less well-known or no-name clients with smaller quantities. With roots in piracy and copycat production, this manufacturing culture was often referred to as *shanzhai* in Chinese (Lindtner, Greenspan, and Li 2015). *Shanzhai* manufacturing is

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characterized by speed to market, enabled by a culture of open sharing applied to manufacturing. Ideation, prototyping, and design happen alongside the manufacturing process, and products are designed in relation to the demands of a fast-changing market. Rather than spending months or years deliberating over the next big hit, *shanzhai* producers build on existing platforms and processes, iterating in small steps. In this way, *shanzhai* brings new products to the market with remarkable speed. For instance, a new mobile phone can go from conceptual designs to production-ready in 29 days.

Even as this manufacturing network grew, few technology researchers or people in the information technology media sector paid much attention to Shenzhen. This began to change around 2012, when a growing number of makers, hackers, entrepreneurs, artists, designers, and geeks began traveling to the coastal metropolis, often motivated by the aim to turn their maker prototypes and ideas into end-consumer products. Well-known examples of these made-in-China devices are the virtual reality goggles Oculus Rift, recently bought by Facebook for over two billion USD, or the Pebble smartwatch. The local government and many of the capitalists and entrepreneurs who invest in the region – Intel being one of them – promote Shenzhen as the "Silicon Valley for Hardware."

In 2013, Intel announced investment of 100 million USD in Shenzhen's "China Technology Ecosystem (CTE)," Intel's nomenclature for *shanzhai*. This was in response to the crucial role that Chinese and Taiwanese companies such as MTK, Allwinner, and Rockchip played in enabling *shanzhai* production by providing affordable yet powerful chip technology. These companies had significantly grown in market share, overtaking Intel in the non-iPad tablet market. As visions of making as site of innovation spread, Shenzhen has become known as *the* technocultural ecosystem that was meant to help deliver on the promises of the global maker movement by elevating local manufacturing culture. Part of my research then was motivated by an interest to understand what it was about Shenzhen and about *shanzhai* production in particular that caught the attention of big international corporations, governments, and independent makers and entrepreneurs.

Silvia found that at the heart of *shanzhai* was the creation of so-called "public boards," or *gongban* (□□), which were production-ready circuit boards designed for either end-consumer electronics or industry applications. For instance, one of the region's largest distribution houses produces about 130 *gongban* per year. It did not sell any of them, but gave them out to potential customers for free, alongside a list of components that and design schematics that went into making the board. The company then made money by selling these components. As such, it was in their interest to support as many companies as possible to come up with creative "skins" and "shells" (called *gongmo* in Chinese) compatible with their boards. Their customers would take a *gongban* of their liking as is, or would build on top of it. The boards were designed so that the same board could go into many different casings – for instance, one board could power many different smart watches and another board many differently shaped mobile phones. In other words, the *gongban* public board function similar to open source hardware platforms popular in the maker movement (such as Arduino), but rather than supporting consumer tinkering, it was used as part of the manufacturing process.

As also described in (Lindtner, Greenspan, and Li 2015), several China-based makers and entrepreneurs have begun to mobilize Shenzhen's history and current transformation *of shanzhai* culture to challenge Western claims of what counts as making and hacking, what counts as technological expertise, and what counts as innovation. They articulate what we might call the "Shenzhen ideology." In many ways reminiscent of the articulation work performed by hackers, writers, capitalists and artists from the West Coast of the United States in the 1960s and 1970s that defined a particular "heterogeneous orthodoxy for the coming information age; the Californian Ideology" (Barbrook

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and Cameron 1996), the makers, writers, capitalists and artists who travel to Shenzhen today are in the process of articulating and so doing remaking the city and its history of computing from a place of cheap copycat production into a global hub of hardware innovation. This remake is envisioned to be accomplished by combining the pragmatist entrepreneurship culture of *shanzhai* with the playfulness and creativity of the maker ethos. These visions of an updated manufacturing culture, freed of its copycat history, have proliferated and figure in international mass media outlets, blogs produced by start-ups, and texts written by venture capitalists; today Shenzhen is often portrayed as the crux to implementing one of the central visions of the global maker movement – the rise of the third industrial revolution. With taglines such as "The Silicon Valley for Hardware" and "Hollywood for Makers," these articulations of the Shenzhen Ideology have not only brought international media coverage and foreign investment, but have also drawn attention from local and national Chinese governments interested in the city's capacity to build up new incubator programs, cultivate a generation of entrepreneurs, and create mass innovation – or a "mass maker space" (□□□□) as the 2015 government policy is called.

Despite the co-option of the term in global technology discourse, *shanzhai* is not a story from the margins. *Shanzhai* production is a multi-million USD global business deeply embedded in contemporary processes of industrial production. In 2014 alone, 2 million smart bracelets and 1 million smart watches were made in Shenzhen and distributed to markets across China, Africa, India, South America, Europe and the United States, where they often sold as no-name brands in Wal-Mart or built up new brands such as Xiaomi and Wiko. The creativity of *shanzhai* production lies in its approach to business rooted in the open production described above that has already drastically shaped global markets of trade, finance, and electronic consumption. *Shanzhai* culture challenges any linear story of China's progress as embodied in the imaginary of Shenzhen as the "Silicon Valley of Hardware," and questions dominant stories of what counts as design, innovation, and tech entrepreneurialism – and where it is to be located. It is yet to be seen if *shanzhai* culture will resist the most recent call for its innovation upgrade and purge of its copycat history.

CONCLUSION: WHITHER MAKING AND HACKING?

Making and hacking have long been understood in relation to a particular, often Western-centric, technological imaginary (Ames and Rosner 2014). With its origins in a countercultural ethos, making and hacking are envisioned to disrupt existing modes of capitalist production in order to open up possibilities for new technologies and a new set of players. While making and hacking have been critiqued as sites of class elitism and gender inequality (Dunbar-Hester 2008; Hicks 2013; Ames and Rosner 2014; Ames et al. 2014; Toombs, Bardzell, and Bardzell 2015), their origins are rarely contested.

In this article, we have explored alternate histories and practices of making and hacking that do not inherently equate them with countercultural logics of the West. Though our examples may come from the global margins, we argue that *all* practices of making and hacking, even ones that appear to conform to utopian rhetoric, are in fact 'making do.' This avoids an overreliance on framing making inherently as 'countercultural' and rejects the binary debates of maker/hacker culture as either a disruptive force or co-opted into the system. Instead, in the cases presented here, people balance hope and precarity, agency and marginalization – they cope with the situations at hand, using the materials and competencies available to them.

What does this tell us about hacking and making in Silicon Valley, often considered the center of hacker and maker culture? We argue that even those at the center are learning to cope with the alienation that can accompany the reorganization of production and

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work practices. There, too, we see elements of marginalization and exclusion – regarding evictions (e.g. The Anti-Eviction Mapping Project 2014), soaring costs of living (e.g. Kim-Mai Cu 2015), gender/race inequity (e.g. Ryssdal 2015), or mental health (e.g. Eisner 2015; Huang 2015), for instance – and of 'making do' with these circumstances. 'Making do' may seem more apparent at the so-called periphery, but there are elements of making do in all practices of making and hacking everywhere.

Thus, our framing of 'making do' reflects an understanding of making/hacking as multiply situated – geographically, economically, politically, materially, and historically. Each of our cases demonstrate that an engagement with making or hacking emerges as a response to specific circumstances, and one that looks both backwards towards prior experiences and forwards towards concrete futures and/or alternative aspirations. For example, we saw in Taiwan and China that as making is being increasingly monetized, practices and sets of expertise that were previously considered as 'backwards' or even holding the nation back in modernization processes (such as craft or manufacturing) are now reframed as progressive, empowering and liberating. At the same time, other kinds of making/hacking, such as infrastructure hacking in Bangladesh, hacking at the margins in Paraguay, or "reproductive" hacking in Vietnam, remain outside these progressive and liberating frames.

The empirical cases that we have presented allow us to theorize what is implied by our shift of attention from 'making' to 'making do.' First, it signals the way that making (and hacking before it) emerges within specific contexts and with particular characteristics that embed it in its locale. Making/hacking, as a practice, responds to local needs, is adapted to local topographies of materials and practices, and yet unfolds in relation to global imaginaries. It makes use of local physical, economic, and human resources. It is embedded in local circuits of people, objects, capital, and skill, and it takes on a particular character within a local landscape of production forms. This is not to dismiss the contemporary hype that surrounds making and hacking that we alluded to at the outset, of a countercultural technological vanguardism and savior of broken educational systems and economies – our point is that we need to see this itself as a local and contingent account of making. Our examination of other makings highlights the historical, political, and economic specificities of those Western accounts.

Second, it signals that acts of making are never singular nor complete. 'Making do' implies a sense of approximation, partiality, and most importantly ongoing-ness. It is done and done again, complete only for current needs, and part of a cycle of successive approximation and accommodation. By moving away from a focus on the *results* of making – for example, a packageable technology or service that can be the basis of a startup, subsequently bought out by a major corporation, and then mass produced and marketed – and towards one of making as an accommodation to immediate needs – themselves in flux and never fully "solved" – our scope includes more of object lifecycles and wider assemblages. This allows us to expand our scope to repair and repurposing, and to observe how objects are brought together to produce new kinds of collective accomplishments in which individual acts of making accomplish only a part of a never-completed whole.

Third, and consequently, 'making do' lets us see the wider frame within which hacking and making exist. We might see hacking/making here not as an alternative to traditional forms of market exchange and cycles of production and consumption, but as existing in parallel – and indeed in intimate connection – to regular markets. In the U.S. and abroad, making is viewed as a significant consumer market, where makers buy kits and other materials, while maker events (e.g., hackathons and maker faires) are scouted by industry for employable talent and/or investment. By 'making do' we do not mean a world set apart, but an alternative configuration

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that accompanies other forms of production and exchange.

What spans all our sites is a glimpse at how people draw upon technology production, making, and hacking to situate themselves within their own shifting terrains as well as within a neoliberal world order. Making in particular takes place whether or not we celebrate or mythologize it, as we saw in Dhaka. Indeed, it may be transformed by those who are able to articulate its meaning for global markets, commodities and innovation culture as evident among the 'makers' we observed in Taipei and Shenzhen. At the same time, those involved in hacking and making may also be responding to or making sense of the global discourses around their actions and may take up the banner of hope themselves, in whatever local and contingent way makes sense to them, as we saw in Hanoi and Asunción. Across our research sites, innovation and creativity were promoted by politicians and corporations alike as a key strategy towards economic development. And yet the instances of making and hacking that we discussed do not fit neatly into this unifying rhetoric of a globalized future of makers.

Finally, we strongly resist any reading of the making and hacking cultures we study as more authentic or more legitimate sites of production. All exist within, and with (at least some) awareness of, global discourses around hacking and making. Craftsmanship and 'making do' may be idealized by makers and hackers themselves (as visible in our Taiwan, Vietnam, Paraguay, and China case studies), and these makers may even appropriate "native" making practices into their branding and marketing campaigns. By focusing on diverse forms of 'making do,' we likewise break with the artificial binary between the hands-on production that, for instance, a hardware start-up performs and the production a craftsman or repair worker performs. Certainly, we acknowledge that tech entrepreneurs and repair workers are positioned differently in relation to global networks of funding and access to social and cultural resources. Nevertheless, making practices – although also positioned differently – necessarily unfold in relation to and through local and global contingencies in all cases.

Throughout, we have attempted to destabilize the myth that making and hacking is best understood primarily in relation to Western political and social concerns. By showcasing the wide variety of activities that can fit under the rubric of 'making' and 'hacking,' we posit that these activities are not purely mechanisms of empowerment (as commonly envisioned), but also mechanisms for positioning oneself in relationship to serious (and seriously disempowering) constraints, including those associated with neoliberal modes of governance as practiced across a growing range of global contexts. We neither wish to romanticize modes and cultures of technology production driven by necessity nor do we argue that our sites are simply yet another form of innovation. Rather, our goal has been to demonstrate how making across our sites functioned as a mode of intervening in and positioning oneself in relation to existing social, economic and political structures.

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[1] The dynamics of this situation and what it means for understandings of technology, mobility and infrastructure are explored at greater length in (Ahmed, Mim, and Jackson 2015).

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