Anthropological STS in Asia

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Abstract

Anthropological STS, distinct from its nearest neighbors social studies of science (SSK), social studies of technology (SCOT), and actor–network theory (ANT), is (*a*) more holistic and culturally embedded than those neighbors and (*b*) in conversation with comparative literature, film, and media studies, including imaginaries of networks beyond national boundaries. Asian STS, or theory from the Global East, rearranges theory from the Global North (traditional STS), the Global South (South Africa), India (postcolonial or subaltern studies), or white settler postcolonial theory from the antipodes. New key journals and networks are centers for STS in Asia. With consciousness of anthropocene changes and biological sensibilities of how systems interact, regenerate, stabilize, or collapse and morph, transform, and become otherwise, this article argues that we need more perspectives, located in different parts of the earth, on our bios and our polis, including revisionist histories of inter-Asian circulations and global circuitries, both as sentinels and as sources for robustness, consent, and legitimacy of flexible and responsive governance of emergent and interacting, if culturally variegated, technoscientific societies.

INTRODUCTION: REDRAWING THE STS MAP

The world has dramatically changed in the past decade or two. As one small index, in December 2015, undergraduates at the Nanyang Technological Institute (NTU) of Singapore launched a nanosatellite (13 kg/28.6 pounds), along with two other Singaporean nanosatellites, two microsatellites (including an NTU 271-pound/123-kg experimental microsatellite to study tropical climates), and one macrosatellite (commercial high-image resolution TeLEOS or low earth orbit) on an Indian rocket that has been delivering space payloads for 20 years (Nowakowski 2015). Asian universities now rank among the best in the world. According to Shanghai-based QS (Quacquarelli Symonds), one of the three global ranking services, 17 of the top 75 universities globally are in Asia: five each in China and Japan; two each in Korea, Hong Kong, or Singapore; and one in Taiwan.[1] The top ten container ports by volume are all in Asia, led by Shanghai and Singapore (World Shipp. Counc. 2016), as are 7 of the 20 busiest airports by passenger volume (*Guardian* 2012).

Because of contemporary issues, Asia is increasingly central to developments and theorizing everywhere. Following is a partial list: simultaneously managing impoverishment and cutting-edge investment in technology, science, and education (bifurcated planning, or what used to be called dual economies, or formal and informal sectors, or simply power relations); global infrastructure [logistics, shipping, urban planning (Krishnan 2013, Shulman 2015, Wu 2015)], nuclear energy production, and transmission (Amir 2009, 2014; Inuma & Tsukahara 2015); ecological management, including animal reserves, industrial farming, biodiversity, and human livelihoods (Chee 2015, Fearnley 2013, Lowe 2006, Onaga 2012, Parenas 2012, Schienke 2006, Sodhi et al. 2008); industrial accidents such as Minamata (George 2002), Bhopal (Fortun 2001), and Fukushima (Samuels 2013) as well as natural ones such as earthquake readiness (Clancey 2006), toxic environments of mining (Golub 2014, Kirsh 2014), and air pollution (Choy 2011); electronics and media development with global circulation and competition [Cool Japan, KPop (Condry 2013, Tinn 2012)]; science cities (Buergi 2016; Fischer 2013a,b, 2016, 2017; Traweek 1988), smart cities (Halpern et al. 2013), green cities (Günel 2014), creative cities and makerspaces (Chen 2011, Lindtner 2012, Murillo 2015, Wang 2015), institutes and national laboratories [e.g., India's IITs, IIMs, TIFR, IISc, PRL, ISRO, THISTI, and CSIR; Singapore's Biopolis, Fusionopolis, Mediaopolis; Indonesia's ITB and Eijkman Institute (Amir 2012; Barker 2005; Bassett 2016; Fischer 2003, 2015a,b, 2016; Inuma & Tsukahara 2015; Mistree 2015; Sunder Rajan 2015); see sidebar for full names of institutes and national laboratories]; new biological research, medical tourism, biocapitalism, alternative or professionalized traditional medicine, and those who are disenfranched from care (Anderson 2008; Aso 2011; Banerjee 2014; Cohen 1998, 1999, 2001, 2005; Ecks 2008, 2010; Fish 2015; Fischer 2016; Gaudillière 2015; Jiang 2015; Lock 2002; Luk 2015; Mukharji 2016; Sunder Rajan 2006, 2016; Wilson 2010); robotics, cultural psychiatries and neurology, the aftermaths of war, aging, and dementia (Cohen 1998, Behrouzan 2016, Fischer 2015b, Lin 2015, Najmabadi 2013, Spedalieri 2014); and technoscientific investment elsewhere in the globe (China in Africa, Latin America, and the United States; Singapore in China, Brazil, Burundi, and India; Japan across Southeast Asia; Taiwan in China).

[1] QS (Quacquarelli Symonds), ARWU (Shanghai Ranking Consultancy), and THE (Times Higher Education and Thomson Reuters) are the three rankings. Despite questions about how these rankings might be constructed, they are powerful drivers in the marketing and internal auditing of universities in the international competition for students, prestige, and respect. In 2014, QS ranked NUS twenty-sixth globally, and NTU (founded in 1991) ranked first globally among universities younger than 50 years old, with its College of Engineering ranking ninth globally. The 2015 numbers are from: **http://www.topuniversities.com/university-rankings/world-university-rankings/2015#sorting=rank+region=+country=+faculty=+stars=false+search=**.

FULL NAMES OF INSTITUTES AND NATIONAL LABORATORIES MENTIONED IN TEXT

CSIR: Council of Scientific and Industrial Research
IIM: Indian Institutes of Management
IISc: Indian Institute of Science
IIT: Indian Institutes of Technology
ISRO: Indian Space Research Organisation
ITB: Bandung Institute of Technology
PRL: Physical Research Laboratory
THISTI: Translational Health Science and Technology Institute
TIFR: Tata Institute of Fundamental Research

Anthropological science, technology, and society (STS) in Asia is, in effect, theory from the Global East that has fast come to challenge, supplement, and rearrange theory from the Global North (traditional STS), theory from the Global South or South Africa (Comaroff & Comaroff 2012), postcolonial theory or subaltern studies from India (Guha & Spivak 1993), or white settler postcolonial theory from the antipodes (Anderson 2002, 2012). The historical antecedents of STS in Asia are also undergoing dramatic renarrations, particularly as the new Silk Roads of rail, oil pipeline, and highway connections across Central Asia are resurrecting old connections and imaginaries, which were once severed by the Cold War. Recovery of networks of sea peoples, merchants, and Hindu, Buddhist, and Christian missionaries (Bugis, Hadramis, Chettiars, overseas Chinese, Armenians, Jews, Parsis, and others) has highlighted both inter-Asian circulations (Duara 2014, Ghosh 1992) and global circuitries (Ooi 2014), including networks of technological and scientific exchange. This has led to revisionist histories supplementing continental agrarian empires and restoring to prominence histories seen from the sea (Ghosh 2008–2013; D.D. Ho 2011; E. Ho 2004, 2006; Rudner 1994). It has also answered more contemporary needs to go beyond "methodological nationalism," which uses zombie categories long after they have become destabilized by national boundary crossings at all scales and levels (Duara 1997).

The anthropology of STS has emerged alongside, and broadens the purview of, British social studies of science (SSK), French actor–network theory (ANT), the Scandinavian social studies of technology (SCOT), and the history and philosophy of science (HPS) (Fischer 2015b). Five features distinguish anthropological STS: (*a*) a detailed interest in the actual workings of the sciences and technologies in a social context, in contrast with cherry-picking cultural metaphors (Fischer 2013a, Ong & Chen 2010, Suzuki 2015); (*b*) a global perspective that replaces knowledge transfer models with attention to exchanges and networks in the making of globally distributed sciences and (dis)articulated technologies (Anderson 2008, Ghosh 1995); (*c*) strategic multilocale and multiscale ethnographic access to complex distributed processes such as the avian flu, biosecurity, and associated ecological management (Fearnley 2013, Fischer 2013a, Mason 2016), the global coal, chemical, petroleum, solar cell, or nuclear industries and responses to accidents and disasters, or global clinical trials and provision of clinical care (Amir 2009, 2014; Das 2015; Fortun 2001; Shulman 2015; Sunder Rajan 2007, 2010, 2011a,b); (*d*) global university experiments in reshaping educational systems for the twenty-first century (Mistree 2015, Fischer 2013b, 2015a,b); (*e*) a concern with the powerful aesthetics of imaginaries, and explorations via bioart, literature, film, and drama of the possibilities of democratizing science, exploring the ramifying effects of technologies, and charting the emotional and psychic investments of both

(Buergi 2016, Dean 2001, Lansing 1991, Suzuki 2015); and finally, (*f*) a practical, media, and pedagogical interest in translating legacy knowledges into public futures, or engaged partnerships with policy decision makers and participatory communities.

Of particular importance here is the historical correction that acknowledges multiple interactive modernities beyond the political economies of colonialisms and imperialisms. In *The Buddha in the Machine: Art, Technology and the Meeting of East and West*, Williams (2014), for instance, attempts to sketch a new history of technology, and of the fantasy of Asia-as-*technê*, that "alters the entire landscape of Anglo-American modernism and its global continuities in postmodern culture" (p. 7). This history extends from invocations of Hindu and Buddhist meditative traditions in nineteenth-century American transcendentalism and pragmatism into the mid-twentieth century cybernetic techne-Zen [of *Zen and the Art of Motorcycle Maintenance* (Pirsig 1974)] and to total quality control Zen-inspired management ideologies and aesthetics. Zen exercises are used in corporations as management tools; Zen aesthetics are cited as style in iconic figures such as Steve Jobs and the iPhone. Today, Japan followed by Korea and now China have become beacons of contemporary techno-chic, cultural cool, flexible creativity (with its undersides of precarity) requiring reminders of mindfulness and balance, but always with a proleptic aspect as in South Korean artist Wang Zi Won's mechanical Buddhas, which suggest new cyborg evolution along with Zen attitudes toward bugs, viruses, and malfunctions. Williams (2014) begins the story of Lin Yutang's pre–World War II Chinese typewriter and of his concern not to simply alphabetize Chinese orthography, lest one cut off access to the vital aesthetics of calligraphy whose qualities affect many parts of life (p. 137). Alternative ways of telling these histories are being worked out by artists such as Entang Wirharso, who puts in critical juxtaposition machines and bodies, highways and superheroes, tropical ecologies and his own family references in what he calls "geo-portraits" of a life lived between Indonesia and the United States and through his bicultural children (Good & Good 2008, Wiharso 2014).

The anthropology of STS in Asia requires new methodologies, indexes of new social problems, and new planning orientations that acknowledge the contemporary technological and science-based nature of society (rather than only a historical-cultural set of differentiations) and that entail profound changes in human-technology-nature investments (financial, psychic, anticipatory, and nostalgic). STS in Asia manifests in variegated configurations from more politicized contests in the STS communities of Korea, Taiwan, and Japan that are analogous to, but different from, the science shops and consensus conferences of STS in Scandinavia and the Netherlands, to more development-oriented dilemmas and moral contests between the common good and individual entrepreneurship in India and China (Sunder Rajan 2016), and to more integrative anthropological and historical approaches in Singapore, China, and Australia. STS has become a growth field, expanding the critical scope of both earlier policy studies and the history of ideas and traditions in the philosophy and history of science that have long dominated writing on science in Asia.

The largest STS communities in Asia are in Japan and are divided between government policy associations for STS civil servants, think tanks, and corporate analysts and at least two academic STS associations, with key English language journals: the *Japan Journal for Science, Technology and Society* (*JJSTS* began in 1992) and the three-year-old *NatureCulture*. The largest cross-Asia network is built around the Taiwan-based journal *East Asia Science Technology and Society* (*EASTS*), with associate editorships for Japan, Korea, and Southeast Asia. A more recent network that began in Australia has an overlapping membership with *EASTS*: Asia-Pacific Science, Technology and Society Network (APSTSN). Another journal is the India-based *Science Technology and Society*, which traditionally has focused more on development but is now increasingly attending to newer forms of STS. Singapore has been growing STS programs at two of its flagship universities,

Taiwan has started one, and China and Korea are beginning to add STS to existing History and Philosophy of Science programs.

AESTHETICS: ART, IMAGINARIES, AND PEDAGOGIES FOR THE FUTURE

Nearest neighbors to anthropological STS have been SSK, SCOT, and ANT, but increasingly they also include social and environmental justice democracy, film, art, and comparative literature. Key sites of technoscientific or technosocial pedagogies and imaginaries include bioart, robot theater, whistle-blowing theater plays [e.g., Singapore's Wild Rice Theater's version (2015) of Ibsen's *An Enemy of the People* (1882) about the difficulties of whistle-blowing, even in a hypothetical case of public water supply contamination], ethnographic and documentary film, circulating video and photography, hard science fiction or science-informed novels, plastic arts and dance, makerspaces, public architecture and new educational spaces and forms, creative cities and universal design, and new imaginaries for societies that are aging (Fischer 2015a,b). At issue are emergent and ecological biological sensibilities, postgrowth invention of ecological communities (including under the sea or in space), and psychoneurological exploration of subjectivities with robots in social interaction with humans (not just human factors in automation).

Among the global imaginaries of our late industrial worlds are those crystallized in Asian experiences and rendered in Asian contemporary arts. The point in listing some of these works is to indicate their richly layered and multiple technological and scientific imaginaries and to insist that we not segregate them as merely an artistic sphere. To do the latter is not only to cripple anthropological STS into the narrow instrumentalities of older STS forms by stripping them of their cultural armatures, but also to look away from the pedagogies of life and the ways of social learning with which they are entwined.

Radiation and other forms of airborne pollution, for instance, are again on the global agenda thanks to the nuclear meltdown at Fukushima Daiichi, Japan, in 2011, the outbreak of severe acute respiratory syndrome (SARS) in 2002–2003, and several avian influenza pandemics from Asia in the late 1990s and 2000s. These of course have many artistic prehistories, which provide alternative imaginaries for technologies and their social ramifications, of which one that knits together localities from White Sands, New Mexico, to Nagasaki, Hiroshima, and Osaka is Oda's (1984) *H: A Hiroshima Novel*. The author, Makota Oda, who was 12 at the time of the bombings over his hometown of Osaka and who later studied in the United States, explores the ladders of manipulative relationships among ethnic groups (Koreans and American Nisei in Hiroshima; Navaho and farmers in New Mexico) and the human connections across the globe. Although his is not a story of radiation, although it is centered around the bomb and World War II, its global connections are not unlike those of SARS and avian influenzas, pulling apart the us–them polarities in which official histories, technological and otherwise, are often narrated. Similarly, the havoc released by SARS in China among Beijing's politicians and the response by denizens of the Internet are rendered in Hu's (2011) brilliantly titled *Such Is this World @ SARS.com*, a kind of ethnographic perspective that is rare in the literature on SARS [except in the work of Mason (2016) and a few intrepid reporters]. Bhopal is an icon of negligent corporate industrial disaster and the spread of toxicity in late industrial society. The latter "second Bhopal disaster," the aftermath of the release of the gas, is ethnographically analyzed in Fortun's classic book *After Bhopal*, as is the similar long aftermath of the Minamata poisoning in Japan documented by George (2002). Updates on the Bhopal case are provided by Sunder Rajan (2016) and in Sinha's (2007) brilliantly angry novel, *Animal's People*, upon which Sunder Rajan also draws.

The deadly 2004 tsunami in the Indian Ocean and the 2011 tsunami in Fukushima are both Asian, world-defining events, which have been associated with climate warming and the increasing frequency and virulence of tropical storms. These events have had a number of powerful aesthetic renderings: in the opening of Abe's (1970) novel *Inter-Ice Age 4*; in Ghosh's prescient novel *The Hungry Tide* (published in 2004 just before the actual tsunami, not only laying out the social dynamics of destruction and the implications of the loss of all identity in techno-bureaucratic systems, but also doing a turn into dolphin science, cetology); and, directly in response to Fukushima, in Murakami's (2015) monumental mural *Five Hundred Arhats*. The last work in this list uses the cultural resources of both post-1990s Japanese pop art and medieval Buddhist, Indian, Japanese, and Chinese art to evoke the March 2011 tsunami and the chaos and terror it unleashed, and it evokes pedagogies through old and new artistic interpretations to hold on to the world and live on (*su-vive*). *Inter-Ice Age 4* is about climate change and sea level rise as well as early computer modeling, and it is especially prescient today for its account of directed biological mutation or genetic engineering, the construction of underwater cities (as Singapore is beginning to do), and the humans and animals engineered to live in them. It is an interrogative account of a scientist who is struggling to make rational sense of a computer [like the early psychiatric program Eliza, devised at Massachusetts Institute of Technology (MIT) by Joseph Weizenbaum] that mirrors his thoughts, without devolving into what he thinks of as emotionality. A similar exploration of the mind of scientific sleuthing, and what I have been calling "scientific literacies" for the future (Fischer 2009), is the series of four stories in *Biogenesis* by cancer biologist Tatsuaki Ishiguro (2015). These works are formatted as scientific lab reports that draw the reader into the policed curiosity and reactions of the scientific communities (including their bias against amateurs, against local traditional medicine, and their asymmetry of recognition between East and West). Each story is about a biological organism that is in danger of extinction, and in sum they are a meditation on the human species itself.

If Abe plots a future under the sea, China's premier hard science fiction writer, and former power plant software engineer, Cixin Liu, takes *The Wandering Earth* [2013 (2011)] off into space, powered by enormous and numerous nuclear plasma reactors. He considers floating nuclear power stations (something that Russia is building and that China and MIT are working on) and explores cyber competition between the United States and China, as well as communication with aliens who have not just a different language structure but immediate readouts so that they cannot comprehend deception. If American science fiction often plots the social future as reruns of American pasts, Liu sets the first volume of his trilogy [Liu 2014 (2006), 2015 (2008)] during the Cultural Revolution (when, in fact, missile and space programs were pursued amid the chaos, something being explored in more anthropological and historical detail by Chang 1996, Luk 2015; for physics more generally, see Fang 2016). In similar fashion, *Decoded* (Jia 2014) is a novelistic account of the cryptographic battles between the United States and China, with the cryptographers in prison-like isolation analogous in their personal movements to the security classification of their work.

No account of the future is complete without some reference to Japan's love affair with robots not just as objects but also as parables of our relations with technology. Director Oriza Hirata and roboticist Hiroshi Ishiguro's series of robot theater pieces ("I, Worker" in 2009, "Sayonara" in 2011, and "Three Sisters" in 2012), inventively explore not merely the "uncanny valley" (when similarity of robots to humans is pleasurable but different, converting into repulsion when the similarity is too close) of robot–human interfaces. They also explore disruptions caused by total recall, in situations where humans for good reason forget. And they explore what to do with companion robots to dying nuclear radiation patients after the patients die. Perhaps such robots can be refunctioned to become reciters of poetry among nuclear ruins for an audience of ghosts, like professional graveyard mourners (Lin 2015, Spedalieri 2014).

An extension of Hirata's experiments in Mumbai is documented in anthropologist Emmanuel Grimaud's experimental ethnographic film, *Ganesh Yourself* (2015). A minimalist robot Ganesh is set up with a vacuum cleaner hose as his trunk, big ears, and a blank screen-like face mask on which faces of speakers sitting some distance away are projected. People of varying walks of life, education, religiosity, believers and skeptics, children and adults, men and women are encouraged to address the god and to test the degree to which he seems to be divine. Involved are all the techniques known well by healers, priests, psychiatrists, psychologists, and advertisers, and most of the audience is not naïve about these gambits. They involve mirroring, silences, assurances, and admonitions that are interpreted by the interlocutors projectively, argumentatively, and in other ways. It could, in fact, be a marvelous teaching tool to get beyond elementary textbook claims about other people's dogmas and beliefs, instilling instead a sense of everyday pragmatism, love of debate, testing, ambiguity, and hermeneutic play.

At issue for STS in all the above works are the emotional and aesthetic facets of science and technology, the social worlds they create and in which they operate, as well as the uneven developments, localizations, and alternative trajectories of the sciences and technologies in different places. Anthropologists used to indulge in fantasies of first contact, and historians in fantasies of identifying critical turning points or key experiments that change common sense, but in fact both anthropologists and historians always step into flows of prior representations, including those of journalists, novelists, ritualists, and shape-shifting cultural forms, tropes, or genres.

Creative efforts to reincorporate traditional psychodynamic sensibilities and ritual processes into technoscientific worlds can be seen in the blessing rituals for motorcycles and rickshaw taxis at a shrine outside the IISc in Bangalore or in the calling back of Brahmin priests in Mangalore or Taoist priests in Singapore when petrochemical machines or bulldozers refuse to work for inexplicable reasons and "development projects" are brought to a halt (Comaroff 2009, Ishi 2015). Ritual sensibilities of addressing anxieties, political violence, and unstable social hierarchies may be further mediated at a distance by photographs and videos that seem to transmit and transform politics to distant places as in Morris's (2000) exploration of the circulation of violence and mystical power via these media technologies in Thailand. Such mystical power might be too easily translated by anthropologists as forms of sorcery or witchcraft but can have long-lasting effects on mental health. Psychological effects of terror are explored in Robert Lemelson's (2009) extraordinary ethnographic film, *Forty Years of Silence: An Indonesian Tragedy*, about former prisoners and their families decades after the 1965 massacres in Indonesia. The fear that perpetrators still in power continue to exert is explored in Joshua Oppenheimer's films, *The Act of Killing* (2012) and *The Look of Silence* (2014).

Film captures things that are not answered by asking who is responsible or how things happened; instead they are about how things live on. The materiality of filmic and performative technologies, as parts of our changing social sensoria, are a field of anthropological STS that is gaining attention. Asian styles, "look and feel," and references, as well as Asian technological relations of production, distribution, and reception are today often in the foreground, even when they are parts of global distributed processes (Condry 2013).

Ritual and belief, and color and passion, also play interesting roles in a long unfolding discussion of and empirical work on complex technologies. These range from debates over the distributed versus centralized nature of regulation of complex irrigation systems and the place of rituals in this regulation to the place of cultural aesthetics in the sciences. In addition to the claims of beauty or symmetry as criteria for good scientific solutions, the nuclear physicist, Raj Ramana (a classical pianist as well as father of the Indian atomic bomb), for instance, tried to show me with chalk on the blackboard how Jain and Buddhist logic and particle physics were isomorphic. The body's performativity in molecular biology has also been a topic of interest in both the West and the East.

The ethnographic examination of technologies of irrigation as organized through temples and flexible kinship organizations has been a classic and ongoing topic, now enhanced with new mapping and modeling technologies: In Bali, Lansing (1991) engages the work of Geertz (1963, 1980), applying (contemporary scientific) programming models (see Howe's 2006 critique); and on the Putien plain (Fujian Province), Dean (2001) has mapped and identified every temple, along with the histories of their regulation of irrigation expansion through land reclamation from the sea and resistance to incorporation into the imperial Chinese ritual system. This is now all made accessible online for further spatial modeling and analysis. Resistance to large hydroelectric dam projects, too, has been a topic of anthropological concern for many decades, but the use of counter-mapping in the border areas of Myanmar and Thailand by transnational ethnic groups as a way of contesting state sovereignties is an interesting twist (Moore 2014). Technologies are rarely only technology but come with interesting cultural armatures.

Another level of aesthetics and creativity lies in the cultural and sociolinguistic conversations that molecular biologists (stem cell biologists, structural biologists) engage with their epistemic objects as exploratory feedback becomes tacit knowledge, skill, and then relatively more stabilized knowledge. In the course of their rhythmic dance (sometimes becoming, in the hands of professional dancers, forms themselves) and phenomenologies of embodiment, Japanese iPS (induced pluripotent) stem cell biologists use Japanese onomatopoetic doublings as both *giongo* (mimic sound) and *gitaigo* (nonauditory or overlapping visual, spatial, and auditory sensations) mappings or quasi-gestural craft languages (Suzuki 2015). They are, as Osaka anthropologist Suzuki reports using her informants' metaphors, "iPS sommeliers," like wine tasters who use refined senses of smell, taste, texture, and terroir, here speaking also of their cells' faces, moods, spacing, crowding, or relaxed robustness. As Traweek (1988) demonstrated in her classic study of the interactions of Japanese and American high-energy physicists at the Tsukuba accelerator, such subtleties can interfere with translation, habits of work, and relations of doing it yourself versus reliance on precision machinists and technicians.

Bioart considers the aesthetics of molecular biology and explores boundaries of technological and scientific protocols and aesthetics, and the broader imaginaries that inhabit them and our technological lives, in parallel ways to work in anthropological STS (Fischer 2009, chapter 4). Such bioart functions not as distanced objects to be admired in a museum, but as spaces of cognitive, emotional, and ethical exploration, much like that of Suzuki's scientists. The work of Ionat Zurr and Oren Catts from Western Australia, in particular, has received a great deal of attention for (*a*) learning from regenerative medicine and molecular biologists how to grow and shape living tissue (doing the technoscience for real, not just as metaphor); (*b*) moving the laboratory equipment and conditions into arts spaces to demystify and democratize biology, but also to instill an ecological pedagogy of care without which living organisms do not survive; and (*c*) propagating notions of contestable design through working prototypes for cultural and ethical discussion. SymbioticA, their research center, has been housed within the School of Anatomy, Physiology and Human Biology, and their work has been shown around the world, including at the Mori Art Museum in Tokyo and the National Art Museum of China (see **http://www.symbiotica.uwa.edu.au/home/about**).

Theirs is but one of numerous so-called DIY (do-it-yourself) biology, hands-on project-based learning, and makerspaces that are spreading outside and/or inside of formal educational institutions, from small scale to large scale. BGI, the world's largest genome sequencing and research institute in Shenzhen, evoking the image of American dropouts such as Bill Gates, has prided itself in circumventing deadening universities and hiring bright young people and training them "on the job," pushing them to be inventive (Fischer 2016, 2017). Although makerspaces often start with three-dimensional printers and other electronics (Raspberry Pi components, Arduino, and

other open-source or cheap hardware and software), they are increasingly moving toward not just building anything but also growing anything,[2] using ideas of synthetic biology.

When Chinese Premier Li Keqiang visited the Chaihuo Maker Space in Shenzhen, in January 2015, he announced a nationwide program to encourage makerspaces. This initiative was part of the innovation and creativity imaginaries and programs around the world and part of other programs such as Creative Cities initiatives, which have also been started by many municipalities across China. Anthropological STS work on these innovations and their supporting networks of inspiration, collaboration, and start-up business plans has begun to flourish (Chen 2011, Lindtner 2012, Murillo 2015, Wang 2015).

A final arena of STS aesthetics and spaces for pedagogy is the design of universities, laboratory buildings, and public spaces, often spoken about in metaphors of biology—science "parks", "trees" of knowledge, planting seeds (Buergi 2016). Much talk about design fostering collaboration, community, esprit, and so on is common, but the explosion of dramatic architecture across Asian cities really has focused attention on innovative ecological or green and blue (water) design, with attention to the spirit of the place and the needs of the environment. Spirit of the place in Chinese settings can mean *feng-shui* (wind–water orientation), which remains important to discussions about buildings in Asia, even ones such as Moshe Safdie's monumental Marina Bay Sands hotel, convention center, casino, and art–science museum complex in Singapore. But spirit of the place can also mean attention to air flow, heat gradients, shade, pleasant circulation of people, quiet spaces, and reconfigurable spaces, as in UNStudio and DP Architects' claims for the design of the new Singapore University of Technology and Design. Such sensibilities are now also becoming parts of the curriculum for students who are seeking to protect aging communities and new nonstandard family formations from developer's bulldozers and overly quick gentrification.

Aesthetics, bioart, and cultural imaginaries imbued with a biological sensibility are anthropological STS spaces for democratizing scientific knowledges. They make more visible and enjoyable the various sorts of care that maintaining living organisms require and the limits that such care and such knowledge of habitat interactions impose. They allow the limits of possibility to be expanded.

THE WORK OF THE SCIENCES AND TECHNOLOGIES IN THE AGE OF NEW SOCIAL FORMATIONS

On the agendas across the world today are so-called knowledge economies involving science and technology, which depend on global universities, big data and simulation models, diasporic and returnee networks. These agendas are shaped by differing political spaces but compete globally over intellectual property rights, trade agreements, and science community niche advantages. To explore this terrain, I use the lenses of three of the more populated anthropological STS literatures in Asia on biology: biology imperiums, the molecular biology and genomics revolutions, and disciplinary institutional competitions.

By biology imperiums, I refer to globally expansive networks of scientific projects that are (*a*) allied with, or moving across, imperial social formations whether in the Cold War period or in the twenty-first century, and (*b*) provide an alternative way to chart the history of developments in the biomedical sciences, that is, alternative to either history of ideas in linear genealogies or to

[2] "How to make anything" has been the slogan of Neil Gershenfeld's Fab Labs, disseminated around the world, from the Center for Bits and Atoms at MIT, now augmented with the help of molecular biology technologists such as George Church to add "How to grow anything." A fab lab was recently installed at one of Shanghai's leading high schools. In August 2016 the global meeting of Fab Lab Academy, led by Gershenfeld, is being held in Shenzhen.

actor networks that eschew larger historical constraints and facilitations. These often include new ecological knowledge about nonhuman actors, not in the ANT way of simply including or enrolling them in human-affected networks, but genuinely mapping out companion species interactions and communal life cycles. Avian influenzas, for instance, that affect both birds and people, require attention to the continent-wide flyways and to varied modalities of interaction (domestication, farming "wild" birds, industrial production, and long-distance transport) (Fearnley 2013).

A key example both of developing new ecological knowledge and also of competition between biology imperiums (Australia and the United States) is the story of the causes of kuru in New Guinea, the discovery of prions, and the precursor to understanding mad cow disease and other prion-related neurodegenerative processes, spectacularly told by Anderson (2008). Anderson follows the career of Nobel Laureate D. Carleton Gadjusek, the genealogical work of anthropologists Glassie and Lindenbaum, the International Biological Program (1964–1974), and the competition between Australian and US research empires to become centers of calculation for tropical disease research. For similar competitions between British and French tropical medicine, Ghosh's (1995) novel, *Calcutta Chromosome*, and Au (2005) have begun to chart Asian perspectives on malaria research in the colonial period. Ghosh brilliantly novelizes the mix of Bengali and theosophical beliefs with British tropical medicine research on malaria, including both Ronald Ross's establishment, with the aid of an Indian technician, of the role of the mosquito in malaria parasite transmission and the deployment of Viennese physician Julius Wagner-Jauregg's tactic to use malarial fever to kill syphilis bacteria, then tame the malaria with quinine.

This period was followed by the competition between Chinese and American research in the Vietnam War period during which Mao's Project 523 on malaria in the 1960s and 1970s succeeded in the isolation of artemisinin by Tu Youyou and colleagues. Today, following the molecular biology revolution, artemisinin is being produced artificially with synthetic biology techniques, and the Anopheles mosquito itself is subjected to genetic experiments to make it a noncarrier.

Anthropological STS scholars are now charting the contemporary pushback to first-world imperiums of multinational pharmaceutical companies through judicialization in India (Banerjee 2014, Sunder Rajan 2016) and, more generally, through contesting and finding alternative biostatistical measures in Japan and Taiwan (Kuo 2009), identifying misdirection of public health through biostatistical auditing in Nepal (Adams 2015), pointing to metrics of surplus health extraction in clinical trials in India (Sunder Rajan 2007), and attempting to patent traditional knowledge in yoga and biodiversity (Fish 2015; Nakazora 2015; Pordie & Gaudillière 2014, 2015). The story of contemporary global infectious disease identification, surveillance, and control also has sine qua non connections with Asia [Avian influenzas, SARS, Middle East respiratory syndrome (MERS)] and has been the subject of anthropological STS work (Fearnley 2013; Fischer 2013a,b; Lowe 2010; MacPhail 2014; Mason 2016; Montoya 2012; Porter 2012).

Traditional Ayurvedic and Chinese (TCM) medicine has been studied in various ways, but a recent wave of studies has shown how it is being reformatted as a modern disciplinary formation that is quite different from its imagined pasts (Chee 2015; Gaudellière 2015; Hanson 2011; Lei 2014; Mukharji 2016; Pordie & Gaudellière 2014, 2015; Zhan 2009). A biopolitical imperium to which inventive ethnographic attention (including new technological techniques of "countermapping") is being turned is tobacco factories in China, how they are hidden in plain sight, and how they utilize corporate social responsibility and other tactics to divert attention and opprobrium (Kohrman 2008, 2015).

The molecular biology and genomics revolutions have transformed how both human health and ecology are considered. Much of the traditional literature on TCM, medical anthropology, and the introduction of biomedicine has been either (*a*) an effort to match the biochemical, bacteriological, and virology revolutions to the history of medicine (e.g., active agents in traditional medicine)

or (*b*) political economic accounts of colonial or postcolonial paradigms of more powerful and arguably more effective biomedical institutions beginning with the Pasteur Institutes in Vietnam, the Rockefeller-supported public health and medical programs in China, the funding of new medical colleges by both Christian missionaries and overseas Chinese, and the powerful effect of military biomedicine and of support for Western medical training from the overseas Chinese during World War II (Soon 2014).

Virological research became a focus of the International Biological Program (1964–1974) and was central to both the international scientific competition between Australia and the United States for New Guinea as a research preserve for their respective ecologists. For anthropologists, a celebrity case in medical anthropology, and its (sometimes misconceived) ability to deconstruct or analyze so-called culture-specific illnesses, emerged around the understanding of kuru disease, a transmissible spongiform encephalopathy, that emerged among the Fore in the 1950s and manifested as a lethal "laughing sickness" with body tremors. As already mentioned, Carleton Gadjusek from the US National Institutes of Health, collaborating with Australian Michael Alpers, won the Nobel Prize in 1976 for identifying what he first called a slow virus. In 1997, a second Nobel Prize was awarded to Stanley Prusiner for his research that recharacterized and renamed the causative agent "prions," recognized later as infectious agents causing mad cow disease or Creutzfeldt-Jakob disease. It was anthropologists Shirley Lindenbaum and Robert Glasse who, using anthropological genealogical methods, first identified the funerary ritual context of kuru transmission (ritually consuming the deceased's brain) (Lindenbaum 2013). Anderson has produced the master text in reconstructing the many strands in this rich story of scientific competition, discovery of new epistemic objects (prions), roles of scientific naming (slow virus, prion), scientific credit (Nobel Prize winners of whom 11 play a role in Anderson's account), localized epidemics with novel transmissions, and institutionalized research ethics and protocols. Alpers established a medical research institute in the area. More recently, anthropologist Alice Street (2014) provides a powerful account of a local nearby hospital, with little of the earlier international interest or support. She describes how local mutual aid interacts with understaffed and underresourced medical personnel. But interestingly as in the earlier period, the personal histories of some of these foreign doctors and local medics themselves map global geopolitics.

Today, virological epidemiological research, with its accompanying demand for ecological knowledge, has become a fieldwork frontier for some of the best new ethnographies (Fearnley 2013, Lowe 2006, Porter 2012) driven by concerns about avian flu and SARS, which in turn have shed light on the failures of Chinese preparedness (subsequently radically improved) and of the continued ricketiness of World Health Organization and global biosurveillance systems (challenged again in 2012 by MERS, in 2014 by new strains of Ebola from West Africa, and in 2016 by Zika virus, triggering surveillance across Asia in all three cases).

Another new critical field of anthropological work, as previously noted, is that of clinical trials and the disciplining (sometimes distorting) role of audit cultures, the role of intellectual property regimes, and the competition between multinational and national pharmaceutical companies. India here is a key player in keeping attention focused on generics. The privately owned Cipla company has been on the forefront of both the politics and legislative debates over postindependence intellectual property regimes; it has played a role globally as well in the story of driving down the costs of HIV/AIDS drugs and tempering World Trade Organization (WTO) rules. On bringing to consciousness the clinical labor of in vitro fertilization in India and Indian global surrogacy, see also Waldby & Cooper (2014), Das Gupta & Dasgupta (2015), and Pande (2014). New medical technologies have often had distorting effects on public health systems and access to care, a topic that is explored largely through kidney transplantation and global medical tourism within and to Asia from without (Cohen 1999, 2001, 2005; Hamdy 2012; Sanal 2011; Wilson 2010).

China and India, home to collectively 36% of the world's population, have specific stakes in the genome revolution now spreading its technical platforms widely into biomedicine, public health, and agriculture (Chen 2010). The largest genomics center in the world is BGI in Shezhen, China, interestingly the result of training networks in Seattle and Copenhagen, the dynamics of moving to Shenzhen away from the conservatism of the Chinese Academies of Science in Beijing, and a small piece of the action in the Human Genome Project (HGP). The first draft of the Human Genome was announced by US President Bill Clinton in 2001 with thanks to participating nations and to the Chinese scientists involved, pointedly excluding China, which was not party to the HGP and, until that moment, was neither interested in nor aware of the potential importance of the HGP (Fischer 2017). This recognition suddenly gave BGI prominence and leverage to tap state grants, service fees, and private support. More importantly, they began maverick hiring of young university dropouts and established their own training academy. In both the United States and Europe, BGI's business plan involves fees for service contracts for researchers and hospitals to generate stable income. In addition to sequencing many animal, plant, and microbiome genomes, and working in global research consortia, a spin-off under former BGI CEO Wang Jun plans to develop an artificial intelligence–based health-monitoring platform for China and elsewhere, based on a million human genomes (Callaway & Cyranoski 2015).

The CSIR in India, after having missed the genetics revolution, vigorously joined the genomics revolution and, among other things, has pioneered crowd-sourcing annotation of the tuberculosis genome (Fischer 2017). Although India joined the WTO–TRIPS (Trade-Related Aspects of Intellectual Property Rights) agreement in 1995 and was given 10 years to reconvert its patent regime from process to product patents, seen at the time as a subordination to the interests of Euro-American big pharmaceutical companies (Fischer 2017), Indian courts denied the right of Novartis to patent a new version of Imatinib (Gleevec) on the grounds that it demonstrated no new mechanism of action or significant improvement in efficacy (Sunder Rajan 2016). It also denied the right of Bayer to prevent Indian generics company Natco from copying and selling the liver/kidney cancer drug Nexavar. India invoked a compulsory licensing provision on the grounds that Bayer was trying mainly to block the Indian company from producing a drug that otherwise would not be affordable in India (Banerjee 2014). Roche dropped its effort to enforce its patent on Herceptin on the grounds that large molecules are difficult to reverse engineer and copy. Several Indian companies have taken up the challenge to prove that they can make biosimilars. The struggle in India over access and incentivizing bioscience for the public good as (often) opposed to production and care for the (now very large) middle class and affluent remains dynamic and unsettled, most similar perhaps to the case in Brazil. India and Brazil are arguably quite different from China, Europe, the United States, and Japan, where the hegemony of the market remains unquestioned for the time being.

Some of the most exciting new breakthroughs in both historical and anthropological STS are four works in the charting of scientific institutional competitions and developments in China. Fearnley (2013) explores not only the role of domesticated wild fowl along the flyway from South China to Siberia and northern Europe in the untangling of possible vectors of avian flu, but also the transformations in veterinary medicine as China attempts to industrialize poultry production, professionalize veterinary medicine, and engage with international health concerns. Chee's (2015) remarkable ethnographic and historical accounts of the use of animal parts in Chinese medicine are both revisionary, in showing how the farming of animals (deer, bears, rhinos, tigers, geckos, beetles) for medicinal use was a function of demands for revenue from export during the darkest moments of the Cultural Revolution, as well as the result of desperate efforts, such as the relatively short-lived craze for chicken blood therapy (inspired in part by Russian organotherapies using internal secretions, today called hormone therapies) to fulfill the demands and slogans of the Great Leap

Forward to innovate. These slogans, "dare to create" (*dadan chuangzao*) and "dare to speak, to think, to do" (*gansho, ganxiang, ganzuo*), are strikingly similar to today's educational slogans across the globe (DIY, makers, hands-on learning, innovation, creativity). After writing a dissertation in the United States on cell aging, Jiang has turned to chart the model organisms, living tissue tools, and experimental biology programs in post-Mao and post-Deng China (Jiang 2015, Jiang & Stevens 2015). Similarly, Luk's work (2015) on the history of biophysics and the space program in China compares and contrasts the formation and social position of biophysics in the People's Republic of China with the case in the United States. She shows how Bei Shizhang, founder of Chinese biophysics, managed to create a niche within the space program, unlike the dominance of biochemistry established by Linus Pauling and others in the United States. Together with Iris Chang's account of Tsien Hsue-shen, the father of the Chinese missile program—trained at MIT and CalTech, chased out of the United States by McCarthy's Red Scare—and such inventive novels as Jia's *Decoded*, which is about continuing cross-national training and competition in public and classified work, we have the beginnings of postnational interacting histories of science and technology (postnational not as universal, singular, but precisely the opposite as multiple, socially and historically textured, and embedded in multiple scales of social action, awareness, aesthetics, imaginaries, social psychologies, and psychic investments).

CONCLUSIONS

I have deliberately avoided the sterile debate about what is "Asian," with which the editors of *EASTS* were obsessed for (hopefully) a short time: It is what the Asian situated, textured, and cultured examples can teach that is of importance. The point has been to construct a Global STS in an attempt to deparochialize the Euro-American focus that still pervades much of the STS disciplinary formation and to widen and enliven the kinds of materials considered, not to create a new regional parochialism. The words "global" and "theory from the global East" may be inadequate for the task, as well. But with the consciousness of anthropocenic changes and biological sensibilities of how systems interact, regenerate, stabilize, or collapse and morph, transform, and become otherwise (both as comparative genomics teaches and also in the science-informed imaginaries of writers such as Abe and Ishiguro), we urgently need more perspectives on our bios and our polis, our biopolis and life-worlds in the broadest sense. I have not here gone much beyond East, South, and Southeast Asia, giving little attention to West Asia (Iran, Turkey, and the Arab world), which I have partially addressed in previous writings (Fischer 2009, pp. 95–113; and further on India, see Fischer 2016).

Anthropological STS involves (*a*) the skills of ethnographic detection—investigative description, evocation, provocation, the finding of strategic intersections of scale (conjunctures, multicausality, interferences, blockages, deflections); (*b*) deep and broad historical tracing of networks of technological and scientific exchange and influence, of cultural knowledges, of local resiliences and resistances, of governance imaginaries of better possibilities, and of the transferences (in psychological as well as material senses) of migration, new beginnings, and recuperations of lively pasts; and (*c*) the increasing use of digital technologies and mapping (as in the SafeCast dissemination of reliable portable Geiger counters and other sensing instruments to create independent, public, and verifiable maps of radiation danger post-Fukushima both in that prefecture and elsewhere and as in new research platforms for data production of air pollution and infrastructure decay, being pioneered in the Asthma Files at RPI with sites in Bangalore, Delhi, Beijing, and elsewhere). These are civil society endeavors that build community and that can verify or dispute official stories, thereby contributing to more robustness and plurality in the governance of society, again a matter of our common biopolis and life-worlds.

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