

universities and encourages a shift regarding the mission of university neuroscience research programs. Importantly, it provides a pathway for investors, as well as pharmaceutical and biotechnology companies to create partnerships with universities and university laboratories. Thus, my principal question regarding translational neuroscience was about the impact of the idea of translational neuroscience on the commercialization of scientific research in university settings. However, in order to explore this question, I needed to inhabit the worlds of the corporate life sciences and that of biotechnology investors. I had hoped that Zack might help me with this, and indeed he did.

I was introduced over email to Zack by Joe Powers, Executive Director of the University of Pennsylvania's Center for Neuroscience and Society where I had participated in a neuroscience training program in the summer of 2009. Joe explained that Zack was someone I had to meet given my interests in translational neuroscience (hereafter TN). I had already heard of Zack Lynch well before Joe's suggestion. Zack's name emerged in conversations with other academics and during early conversations with pharmaceutical executives. I had even seen him on television, discussing his book, *The Neuro Revolution: How Brain Science is Changing Our World*, a book that explores how emerging technologies in neuroscience may radically transform the world.

Zack's book is a useful introduction into the world of neurofuturism, a field of inquiry and imagination focused on expansive opportunities and transformations that may occur via increased understanding of the brain. To be clear, Zack's coauthored book is a work of technological futurism: focused on all of the social areas in which future neurotechnologies should revolutionize human life. For example, the book discusses how new brain technologies (including software) will be used to hone financial traders'

decision-making or how neurotechnologies will be used by dating services and in judicial contexts; invoked in the latter case in order to examine issues of a subject's risk for criminality and as a means of lie-detection. Organized around a notion that the "Neuro Revolution" will comprise a major economic and historic revolution, Zack places it historically alongside the industrial, information, and agricultural revolutions-- all of which produced dramatic social, cultural, and economic effects. For some reviewers, the book was too hyperbolic, nothing more than unstructured futuristic prognostication. Yet, one can also read the book as a meditation, a serious consecration of a moral future slowly unfolding: one in which human decisions are improved, where brain diseases are eradicated, and where people, now thoroughly understood and demythologized via brain science, will be able to be romantically matched to others who are neurologically, psychologically, and emotionally optimal mates.

Zack begins the book by recounting a telling experience in which he was, in a word, *saved* by biotechnology. While on an international vacation, he had a skiing accident that produced a painful and debilitating back injury. After years of searches for cures and medicines, a neurosurgeon ordered Zack to undergo a full-body MRI scan in 1996. Zack describes the experience of being fully immersed within the scanner: its cacophony of sounds, the visual claustrophobia. In Zack's narrative, it was the magic of the MRI scanner that enabled the doctor to find the diagnosis that led to his recovery. In my reading, this moment constituted a kind of biotechnological conversion narrative: a thoroughly technological soteriology. There, as he emerged from the scanner, Zack (Figure 1) received what he called, "an invaluable inkling of the future" (Zack and Laursen 2010, 2)



Figure 1. Zack Lynch in his home office, in the basement of his house in San Francisco's Noe Valley neighborhood. He and his wife, Casey Lynch, are the owners and directors of NeuroInsights. Image, San Francisco Chronicle. Copyright © 2014 SF Gate.

While Zack is many things - investor, principal of his firm, entrepreneur -- he often discusses his background as an economic geographer studying how and why industries emerge, how they develop and the reasons why they do. Zack explained exactly what demarcates him from others: speculators, neuroscientists, investors, and investment advisors working in the neurotechnology space. He considers himself a *tracker*. Importantly, he also articulates the importance of understanding how various stakeholders in the translational system may be so domain-focused that they are not able to clearly see how they are part of a larger sociotechnical and historical configuration:

*Specialists are very powerful at being able to tell you what's going [in their own domain] but they can't tell you about converging technologies and so being a*

*tracker, its very difficult to get people to – other than venture capitalists and even they have an issue with it - to sit down and talk about drugs devices and diagnostics[at large] and you're either a biotech person in your silo or you're a medical device person or you're diagnostics, personalized medicine...but to me [these larger trends] it's the essence... and you have to take into consideration converging technologies... You've got to really embed yourself in as much random stuff as possible... so you're not missing texture... I'm like a massive data collector. (Interview 07 February 12, 2010)*

Zack's use of the term, *tracker*, coalesces with the positionality of the ethnographer, simultaneously on the inside and the outside. And in many cases, this describes the radical heterogeneity of his daily routine. During the annual Neurotechnology Industry Partnering and Investing Conferences, Zack adroitly introduced investors to startups, deploying enough neuroscience knowledge to know why one particular startup might be of interest to a given investor. On another day he is in Washington D.C. lobbying congress or writing Op-ed pieces. In each case, he strategically uses his on-the-ground knowledge to structure arguments about trends, challenges, and larger logics at work within commercial neuroscience or to convince, for example, investors to take interest in a new crop of neurotechnology startups focusing on devices.

Thus, tracking refers both to the wide diversity of his experiences and data-sources as well as his use of these experiences in his work. Zack told me, “I don't consider myself to have an [high] IQ, but I have this ability to deflect and immerse...” Zack runs in many related and interconnected circles: biotechnology startups, private equity executives, pharmaceutical company leaders, Silicon-Valley entrepreneurs, neurofuturists and neurogamers, popular neuroscience writers, Bay Area neuroscientists, and “normal” professors, but his wide interests do not signal dilettantism. His positionality is firmly rooted in allegiances to both economic markets and genuine faith

in neuroscience itself. Thus, Zack's commitments and location within the world of neurotechnology means that his tracking enables him to be an effective and diversified broker of the brain. Given Zack's location in various microworlds, he was a particularly important interlocutor for me as I sought to develop emic understandings of large-scale shifts at work within commercial neuroscience and neurotechnology investments. His perspectives were so contoured by his faith in neurotechnology that his insights often offered me useful direction in terms of getting at emic meanings.

In 2003, Zack and his wife, Casey, founded the aptly-named firm, NeuroInsights, an organization uniquely positioned in the world of neuroscience, neurotechnology, and life science investment communities. While NeuroInsights provides several services, they are largely a market information, tracking, and analysis firm. Each year NeuroInsights produces the highly influential "Neurotechnology Industry Report." The 2013 The Neurotechnology Industry Report, for example, costs \$5,700.00 to purchase and is 600 pages long. According to the product description, "its the only publication to provide a comprehensive pipeline and market analysis to help investors, companies, and entrepreneurs easily identify opportunities, understand the competitive landscape, determine risks, and understand the dynamics of rapidly changing CNS [Central Nervous System] markets."<sup>1</sup> The report links networks of entrepreneurs, investors, and biopharmaceutical, device, and biosoftware companies otherwise difficult to access. NeuroInsights also works at the interface of neuroscience and translation in that the firm provides strategic business and advisory services to small neurotechnology companies

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<sup>1</sup> <http://www.neuroinsights.com/marketreports/marketreport2013.html>

looking for investments, while also providing advisory services and investment leads for those seeking to invest in neurotechnology companies.

Zack also founded the Neurotechnology Industry Organization (NIO) a trade organization composed of neuroscience-related companies, organizations, university research centers, as well as pharmaceutical and medical device companies. This organization focuses on lobbying efforts around federal research funding as well as advocacy for a host of industry interests in everything ranging from taxation of investment gains to regulatory issues of the U.S. Food and Drug administration (FDA), which must approve neurotechnologies before they can be brought to market. NIO and NeuroInsights produce annual events nationally and internationally designed to create opportunities for partnerships and networking between scientists and investors, between pharmaceutical executives and biotechnology start-ups, among others. These “Neurotechnology Investment & Partnering Summits,” constitute key spaces where TN “happens.” I focus on my experiences at these events in Chapter Three.

Thus, Zack is uniquely positioned -- touching spaces ranging from laboratory discovery all the way through commercialization. To an outsider, he may be a “big man” of neurotechnology. Yet, this fails to grasp the personal importance of the brain for Zack. When talking about emerging technologies, Zack speaks quickly and excitedly:

*So let's go into cochlear implants, brain stimulators for Parkinson's and there's a whole frontier of emerging neurodevices to treat a whole series of things and not only psychiatric [diseases]. One company developed a portable TMS [Transcranial Magnetic Stimulation machine] for migraines that goes beyond magnetism and that goes to light therapies that are non-invasive. There are also all the surgical procedures and so it's where it's all going... (Interview 07 February 12, 2010)*

Like the investors with whom I spoke during my fieldwork in the late 2000s, Zack invokes the future in order to contextualize (and often de-problematize) the present. He says, “the crudeness of 2005-2020 when people look back from 2040 will be like the invention of propeller planes... it’s like, ‘can you imagine that we couldn’t fly to Hawaii?!’” I asked Zack about the concept that he’d created called, *neurosociety*. After a moment, Zack provided an explanation:

*Humanity has gone through an agricultural society. Currently we’re in an information society where information technologies drive fundamental political economic and social change and so if you look at history you realize that new societies emerge when new technologies develop, and co-evolve with sociocultural norms; you get these techno-economic waves and they give rise to new forms of human society that are different from predecessor societies. My background is as an economic geographer – [studying] how and why industries emerge and how they develop and why they do and the reasons why they do. I coined the term neurosociety and what this represents is a society where neurotechnologies begin to transform political and economic relations, sociocultural relations, business methods, personal patterns of interconnectivity, ways of being, ways of seeing, ways of existing, and norms of our lives – [and] ...in many ways [are themselves] radically influenced by this society. That’s what the neurosociety means ...*

*I mean you have these grand revolutions – agricultural, industrial revolution, then information revolution and then the neurorevolution, within those, you can pick out and tease out even more finely grained patterns of technological development that are tied to the capitalist mode of production...and so Nikolai Kondratieff, who’s a Russian economist - came up with classic analyses of these techno-economic waves. [Economist] Joseph Schumpeter was a big fan ... he [Schumpeter] came up with the term creative destruction....and so this idea of these techno-economic waves, they emerge and then go through a process where low cost products engender entirely new ways of doing business, they impact industries that already exist, they require new industries which create new modes of work and which create new modes of living. (Interview 07 February 12, 2010)*

For Zack, there is a crucial relationship between emerging innovations in neuroscience and economic transformations “tied to the capitalist mode of production.” Zack’s invocation of “techno-economic waves” may get at the inextricability of “the social” and “the technical” that early economic historians such as Schumpeter and Karl

Polanyi prefigured in their theorizations about massive social transformations emerging out of technologically-enabled industrial capitalism (Polanyi 2001). However, this convergence is also exemplified in concepts such as that of the sociotechnical ensemble, which places analytical weight on the *inextricability* of both the social and the technical in explaining techno-social change (Bijker 1997). The kind of sociotechnical historiography that Zack uses to explain how “...new societies emerge when new technologies develop, and co-evolve with sociocultural norms,” makes his notion of neurosociety legible within recent theorizing regarding the co-productions or mutual constitutions between evolving life-science epistemologies and capitalist-economic exchange (Rajan and Leonelli 2013). For Zack, this “techno-economic wave” that neurotechnology enables isn’t simply an exercise in elucidating the vicissitudes of history: it’s about a nascent utopia that will be unveiled in the commercialization of neurotechnology.

It was during our conversation of February 12, 2010 that I began to wonder whether TN might not be a useful sphere in which to map a set of economic shifts coordinated with social transformation. I take Zack’s prognostications to be less technological determinism and more a kind of economic constructivism that effectively reveals the way economic transformations enabled through technology (and especially biotechnology) become a vital space of social and relational transformations. Zack is an ardent evangelist whose futurism is animated by social concerns that emerge from the inevitable inequalities increased technological efficiency is likely to create. As with many libertarian moralities, the problems of inequality are perceptual. When I ask Zack about the social and political futures that neuroscience will author, his statements become



dramatic and prophetic. For Zack, our impending neurotechnological future will be grand, utopic and moral. I lean in. He continues:

*I'm gravely concerned about humanity's future. I have been ever since I was a young child. My mother took me on a trip to India when I was like 13, and we meditated for six weeks and on my way back we stopped at Dubai airport...and I saw this radical difference in the disparity of wealth and [came to the conclusion that] when everyone else figures out what everyone else has there will be a cultural war. The most powerful way that we'll be able to influence humanity on a broad scale ...are these new neurotechnologies -- whether they are used for warfare or sophisticated neuromarketing and neuropsychology or rapid education or training in empathy, to me this is where humanity must go. (Interview 07 February 12, 2010)*

Zack's contention, although dramatic, helps one think beyond a view of TN as simply a highly commercialized mode of neuroscience research or as a simple story of science, commercialization, and neoliberalism. It is also more than the enactment of epistemic transformations animated by global economic processes. Zack's sentiments compelled me to begin to think about TN as a means of moral envisioning: a reflection of a set of designs for intervening in global health and the market. TN reflects a neoliberal materialization (literal) of a notion of the good.

This materialization is also ineluctably commercial according to Zack: innovations in the brain sciences not only offer an opportunity to enact more equitable global futures, but also help to alleviate disease burdens, and this is where the more immediate impacts of TN shall be felt. Yet, Zack's tone regarding the morality of TN retains a sense of moral imperative. "There are 2 billion people suffering from brain-related disorders!" Zack quickly recites all of the diseases and conditions considered brain-related disorders -- everything ranging from Alzheimer's to depression and

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