How to Make Sense:
Sensory Modification in Grinder Subculture

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ABSTRACT

How to Make Sense: Sensory Modification in Grinder Subculture

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This doctoral research examines the Canadian and American grinder scenes to gain insight into the role of senses in understanding and responding to social problems. Grinders, a subset of biohackers, aim to enhance themselves by assimilating emerging material technologies (including, but not limited to, electronics) with their bodies through experiments and surgeries. They opt for a do-it-yourself (DIY) approach in order to maintain a sense of agency that might be lost if pursued through traditional means, such as 'normalized' medical research, ethically constrained university research, or market-driven private industry. How do grinders make sense (literally and figuratively) of their bodies as a site for enhancement?

The research design included three years of virtual ethnography of online grinder hubs, which were connected and contrasted with a concurrent two years of 'real world' participant observation ethnography at grinder laboratories and events. Data analysis applied actor-network theory to trace grinders' sensory assemblages through a variety of on- and off-line sources. These included internet forum posts, IRC chat logs, and blogs, as well as 40 in-depth interviews, dozens of informal interviews, and direct observations of grinders planning, surgically implanting, and using their 'enhancements.' Results demonstrated how grinders position their bodies both broadly in relation to their current social circumstances, as well as specifically through three case studies involving magnetic implants, RFID tags, and body-computer interfaces.

This study is situated in Cyborg Anthropology and Science and Technology Studies to understand the relationship between bodies, technology, and culture. Findings suggest grinders conceive of the human body as an ironic hybrid of positivism and constructionism, determined by its techno-biological material yet simultaneously amenable to endless modification. In practice, however, the results of the tension between stability and variability tend to reinforce hegemonic social and economic relationships. What grinders ultimately enhance is the ability to adapt their physical bodies to social uncertainty brought about by the accelerating digital economy of information.

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Chapter One
An Introduction to Grinders

The neighbourhood is a contract police zone, overrun by pillheads. Street graffiti preaches, "Not my future," "You owe me a flying car," and "Where's my fucking jet pack." A passerby remarks, "The future is bullshit. The future hasn't changed in ten years. It's never come, and I never want it to." Inside the nearby Shank Valentine bar, a recently deceased bloody corpse is spread across a grimy table. A man wearing overalls with surgeon's tools peeking out of the pockets takes a drink and says, "The kid's grind went bad. Shock stopped his heart. Couldn't restart it." The Shank Valentine is a grinder bar. While everyone else waits for the future they think they're owed, grinders work together to modify their bodies, assimilating with technology to make themselves *better*. They have eyeball implants that keep track of their friends, electronic pills that monitor their health, and implanted computer chips that facilitate invisible communication. These enhanced senses are not shared by everyone – the grinders have access to realms of sensibility to which others are completely unaware and have no way of verifying. It is perhaps for this reason that others call them *tricknologists*. Their modus operandi is to apply existing technology to rearranging their bodies and become someone else. This is the near-distant future of *grinding*, at least according to Warren Ellis' graphic novel where the term originated, *Doktor Sleepless* (2007).

Seven years after the first issue of *Doktor Sleepless* was published, I was in a makeshift surgical room just outside a small town in central California. One person had implanted a small solar panel in their arm, another dropped experimental enhancement chemicals in their eyes, and several people implanted magnets into their hands. The procedures, done by a man wearing surgical scrubs, were relatively clean except for a few drops of blood that were quickly absorbed by sterile bandages. No one was hurt. In fact, unlike the comic book that gave them their name, these self-described grinders were welcoming, generous, and generally careful. What the two versions of grinders do share, however, is a distaste for speculative futures and an interest in human enhancement through implantable technology. Beyond that, it's hard to define exactly what a grinder is.

The popular media I've collected over the past six years readily associates grinders with cyborgs, biohacking, DIY bio, and transhumanism, describing them as "renegade body-hackers"

(Papenfuss 2016), “biohobbyests” (Ossola 2014), “hardcore hackers” (Mallonee 2017), “body architects” (VICE 2017), “superhumans” (White 2016), a “body hacking movement” (Peralta 2016), an “extreme clique” (Wortham 2015), an “underground medical movement” (Booton 2016), “medical punk” (Hines 2018), and “bringing dystopian fantasies to life” (Jackson 2017). Some of the grinders I’ve met would agree with these assertions, and others would vehemently argue against them. Some readily identified as transhumanists and biohackers, and others demonstrated disdain and hostility towards those who claimed to be transhumanists and biohackers. Some want to enhance their bodies; some want to replace their bodies entirely. Some are technodeterminists to be sure, but some are activists, some claim to be apolitical, some are laypeople, some are casual hobbyists, and some have backgrounds in nuclear fusion, biology, engineering, health services, electronics, or some combination thereof. How does such a diverse group of people and ideologies end up loosely tied into the word *grinder*?

My own interest in grinding began in 2011. I was working on my Master’s thesis at the University of Ottawa. My topic concerned how a relatively simple change to surveillance laws (that is, how the state ‘sees’ its population) gave rise to a complicated neoliberal governmental apparatus. When I learned that people were actively attempting to modify their senses, I saw potential parallels for how new forms of perception might create and alter social networks on a different scale. Senses are literally how we make sense of the world, so to what degree does adding or modifying senses change that world? How does modifying senses solve or create problems? How does it open up new spaces of understanding? And once I came to appreciate the diversity of grinders, I also wondered what sorts of things they wanted to make sensible, and other things insensible? Moreover, to what ends must one go to pursue these questions, and what might be some of the unintended consequences? In short, how do grinders *make sense*?

Over the years of this research, I found the diversity of ways in which grinders made sense of their activities proved to be as varied as the people behind them. Of the grinders I met in person most were in their twenties or thirties, but the full range included teenagers to people in their fifties. Their heterogeneous professional, educational and ideological backgrounds diverged as much as their hopes for the devices they were building. Consider the projects of Rich Lee and Grindhouse Wetware.

Rich Lee is one of the earliest and most vocal proponents of the grinder scene. The first time I met Rich, his imposing stature and intense gaze were almost immediately superseded by a

sincere friendliness underlined by an unending curiosity. No matter what the topic of conversation, Rich seemed to have already done some research on the subject. Yet at the same time, he never claimed to be an expert and was always asking questions to probe whether there was something he had overlooked or might be considered from another perspective. Rich will give serious thought to almost anything, even (or perhaps especially) preposterous ideas. A subsample of the ideas he has pursued include implanting a tazer to shock others, implanting a lattice of wires and supercapacitors that renders tazers ineffective against him, adding a sixth finger, transplanting fingernails to grow natural body armour, a slew of genetic modifications, and his pet project, the Lovetron9000 – a vibrating haptic subdermal device to be implanted near the pubic bone.

In contrast, Grindhouse Wetware is a collective of enterprising grinders who have developed a number of implantable products for human augmentation. Among these devices include the Circadia, which is a biomedical implant that measures body temperature and sends warning messages about discrepancies to a smart phone if, for example, the user might be getting sick. They also are about to release the Northstar version two, an implanted disc that records motion and can transmit programmable Bluetooth messages. A pre-determined hand gesture could, for example, open a garage door.

Rich's ideas and Grindhouse's products are very different implants for very different lifestyles. Not only are their purposes developed out of particular social milieu, their eventual applications may be redefined by the user's purposes. For example, implanting or being immune to tazers has different implications depending the user's political circumstances. Making sense of these implants thus requires understanding where they came from and where they go.

A cyborg manifested?

The question of making sense is multi-layered. Grinders have to make sense of making senses, and I have to make sense of them making sense. To answer this question, I began with the assumption that sense can be made and worked my way outwards. Modifying senses by implanting technology into the body raises questions underscored both by tensions between its humanist assumptions and posthuman ambitions, as well as by (and related to) grinders' inherently reflexive sensory practices of self-experimental knowledge making. Based in cyborg anthropology, my theoretical approach thus builds primarily on (post)humanism and Science and

Technology Studies (STS) literature and is further supported by anthropology of the senses and sociology of the body literature.

First, I begin by referencing a seminal text in cyborg anthropology, Donna Haraway's (1991) *Cyborg Manifesto*. When I do so, I am not alone. The manifesto has been posted on the grinder internet forum *biohack.me*, and to my delight, several grinders read it. In it, Haraway invokes the figure of the cyborg to challenge essentialist patriarchal logic, and in particular the idea of 'natural' gender. The cyborg offers an alternative by its lack of boundary; it is outside or post-gender since it does not rely on human reproduction. Instead, it relies on hybridity – between humans, animals, and machines, and also between the physical and non-physical. Importantly, Haraway rejects identity politics in favour of a politics of affinity and unity. Gabriel, one of my informants, has taken up these arguments by Haraway:

> Her whole point was by having control over our biology we'd be able to subvert the means of oppression… what does it mean? How do you be racist when everybody is hot-swapping their colours? How do you be sexist when you can hot-swap a gender?[1] … Oppression directly correlates to lack of control, right? And so grinding is all about getting control of yourself.

I originally read Haraway's Manifesto as using the figure of the cyborg to move away from the conceptual and material limits of the biological body. Gabriel's interpretation, however, instead doubles down on the biological body, except he takes the biological as already a cyborg, where, for example, cells are and always have been a modifying technology. The outcome of this perspective can be seen in his views on gender. At first glance, the grinder scene is ostensibly dominated by white males, though over the course of my fieldwork it became increasingly populated by women, transgender, and gender-neutral identities (this was most explicit in BodyHax conference presentations, where Haraway references abounded). Biohacking implies gender and body fluidity. Again, Gabriel hypothesizes why this might be:

[1] "Hot swapping" refers to the ability to replace or add components to a computer system without having to shut off or interrupt existing computer processes.

> One, grinders are almost to a T, to a fault, weird about bodies. I mean, if you're sitting at home talking about how you're going to implant a vibrator into your pelvic bone, you're obviously a little more comfortable with biological fluidity. You know? You're already starting to push the boundaries. The other one is that, honestly, transgender people are, you know ... biohacked. Like, sure, you got a magnet in your finger? I've got a whole new set of genitals. And I mean, the other thing is that we do have a very young community and the youth of today are often more gender fluid.

There is tension between the above two quotes from Gabriel. What is it that grinding seeks to enhance: Control over yourself? Or an affinity? Can they overlap? And what happens when they do not? Within a grinder mentality, if gender is socially constructed, then it is fluid; and if gender is the result of hard biological determinism, then it should also be changeable by altering (or supplementing) biology, and therefore it is still fluid. Is this a distinction without a difference? I frequently observed throughout my fieldwork how grinders conceive of the human body as an ironic hybrid of positivism and constructionism, determined by its techno-biological material yet simultaneously amenable to endless modification. These questions and contradictions are recurring themes throughout this thesis, and they stem from deep philosophical and historical roots.

The practice of grinding is in many respects a humanist endeavor that raises questions of biopolitics. While the concept of 'humanism' has multiple meanings in different contexts it can be generally understood as the pursuit of humans to achieve their highest aspirations, particularly through scientific means (Lamont 1997; Vaughn 2003). This requires an underlying assumption that humans are free, rational actors, capable of shaping their own identity and dominating the natural world (Davies 1997; Ehrenfeld 1981; Lamont 1997). Certainly, grinders appear to conceive of the body as a something that can be made knowable and therefore malleable and controllable. However, the stakes of how one defines 'free' or 'rational' are quite high, as evidenced in anti-humanist critiques.

In particular, there is an abundance of anti-humanist literature that challenges humanist perspectives of 'freedom' notably in relation to class, gender, and race. The works of Marx and Foucault are unavoidable for their demonstration of the essence of 'man' as a polymorphous,

historically contingent concept (Braidotti 2013; Davies 1997; Foucault 2002[1970]), and contemporary literature has bolstered their broader arguments with more palpable day-to-day examples of how reducing the body to a particular humanist concept leads to social inequality (Crossley 2006; Latour 2004; Mascia-Lees 2011). For example, gene research has been criticized for reducing humanity to its DNA, which has led to biologically determinative practices of racial profiling and social hierarchization (Fox Keller 2000; Marks 2003). Likewise, taking the "white, European, handsome and able-bodied" Vitruvian Man as an ideal human baseline has supported practices of gender subjugation (Braidotti 2013, p. 24; see also Badmington 2003; Butler 1993; Grosz 1994; Mouffe 1993). These studies show not only that reducing humanity to a particular abstract concept makes it impossible to account for the complexity of lived experience, but also how scientific inquiry does not counter ideology with truth but rather is itself built on ideological assumptions. When grinders design and use their implants they are also making biopolitical decisions about what is important and/or useful for life itself, and therefore act towards particular biopolitical ends. The question of how technology disproportionately affects social relations such as race or gender, as well as the ensuing political or normative implications raise questions about how these choices are made, are pressing concerns within posthumanism literature (see Croissant 1998; Davis-Floyd and Dumit 1998; Gray 2002; Habermas 2003; Winner 1989; Woolgar and Lezaun 2012) and will certainly be elaborated by the case of grinders.

Over the past several decades these arguments have been bolstered by Science and Technology Studies, which details how certain ontologies become and remain pervasive social 'facts,' and subsequently attempts to unsettle their underlying assumptions. Often referred to as the 'ontological turn' of social sciences (Henare, Holbraad & Wastell 2007; Law and Lien 2012; Stengers 2005) I draw in particular from laboratory studies (Latour 1987; Latour & Woolgar 1986) and related studies which trace material arrangements such as pipelines (Barry 2013), scallops (Callon 1986), scientific lasers (Collins 1985), and DNA sequencers (Helmreich 2009) as a singular objects that come to create complex social worlds through mediation and political dispute (Latour 2005; Law 2004). These studies emphasize how mundane, every-day practises accumulate into larger effects, which is where I began to look for emerging biopolitical sensory disputes.

Second, this research builds on anthropology of the senses literature to complicate the 'ontological turn' with its focus on epistemological issues. Senses literature has demonstrated how sensory perceptions relate to culture and the ordering of societies (see Bourdieu 1984; Howes and Classen 2014). There are numerous examples of how senses order gender (e.g. how touching is performed differently by women and men; see Synnott 1993), class (e.g. how scents distinguish rich and poor; see Classen, Howes and Synnott 1994; Stallybrass & White 2007; Synnott 1993, pp. 190-194), and other social positioning (e.g. deaf people being treated as mentally incompetent for much of Western history; see Howes and Classen 2014; Rée 1999). While we may not be able to predict how the sensory modifications of grinders disrupt such culturally inclined sensory orderings, they nonetheless direct this present inquiry by offering examples of social reconfiguration through parallel examples. In other words, what is important to grinders, or literally what makes sense to them, is being altered alongside their bodies.

As an example of how changing senses can reconfigure social possibilities, Sacks (1989) and Rée (1999) report how deafness fosters non-aural linguistic practices that can exploit both space and time through hand gestures comprised of position, shape, and movement, ultimately making it possible to consider and combine ideas simultaneously. The result is an incredibly complex form of communication unavailable through strictly aural means. Likewise, multiple scholars have analyzed the art experiments of Stelarc[2], which challenge the physical limitations and skills of the human body by interfacing it with cyber-systems, networks, and machines that improve functionality (see Farnell 2000; Lemma 2010; Massumi 2002; Pitts 2003; Zurbrugg 2000). While deaf culture relates to a different sensory modification, and the temporary and solitary nature of Stelarc's experiments are limiting, together they suggest grinders' manipulation of hybrid machine/human bodies will be of significance to anthropology of the senses literature by creating the conditions for new realms of sensibility.

Third, sensory modification is something done both *with* the body and *to* the body, something on which sociological literature has much to say. Here, I take 'making sense' at the second degree, that is, how socio-political context is related to how grinders make sense of making senses. It is trite to say that markedly different bodies historically have led to socio-political oppression. An obvious example is slavery tattoos, which served as material and

[2] At the time of writing this, Stelarc and some grinders have begun collaboration on an upcoming project.

symbolic markers of social cohesion (Synnott 1993; Turner 2000). Modifications like tattoos can indicate not only tribal affiliation (both inclusively and exclusively), but also, for example, social status, rank, and the completion of rites of passage (Demello 2011, p. 339; Favazza 2011, pp. 129-130; Lemma 2010, p. 150). That grinders implant underneath the skin mark a new development in this historical trajectory, as visibility and invisibility are a recurring theme throughout this dissertation, particularly in relation to their function in inclusionary and exclusionary processes.

Relatedly, from a phenomenological perspective, accounts of the body relate the sensory capacities of the body to social experience. In other words, the sensory body is linked to 'sense-making' of the world outside of it. Within the phenomenological body, perception is not 'in the head' but in the entire perceptive body, which means the body is the basis of meaning and creating knowledge by acquiring skills and techniques through habitual actions (Crossley 1996; Merleau-Ponty 1968; Schilling 2005). However, as Merleau-Ponty made clear, our perception is flawed since our senses are limited; we cannot sense *everything* (Merleau-Ponty 2007, p. 139). As such, objects in the world that appear stable are merely in a state of perceptual equilibrium, and these perceptions are mutable and only probable (Merleau-Ponty 1968, 2007). This affects one's understanding the actions of others, since we can copy and imitate behaviours via mimesis between perceiver and perceived until "contact and copy merge to become virtually identical" (Taussig 1993, pp. 19, 21; see also Merleau-Ponty 1968). From a phenomenological standpoint, then, the activities of grinders create interesting questions when actively modifying their sensory abilities, as they are also reflexively altering their ability to experience and understand the world and each other. Grinding is a *reaction to* and an *enactment of* the limits of sense-making. As an example, consider that mimesis also allows humans the ability to falsify, mask, pose, and therefore misrepresent (Taussig 1993, pp. 42-43). When grinding unsettles a 'sensory equilibrium' by enhancing some people but not others, it both increases opportunities for such results, and instigates grinders to take precautions against them.

The position from which grinders begin, however, is not a blank slate. Unlike the phenomenological body that *acts,* inscriptional accounts of the body focus on how the body is already *acted upon* (Crossley 1996). Mauss (2007 [1935]) was one of the first to observe how people from different societies use their bodies in culturally specific ways. These "techniques of the body" are manifest in learned behaviours that can be difficult, if not impossible to unlearn

(Mauss 2007 [1935], pp. 50-53). Bourdieu (1984) expanded on these ideas by showing how correlations between class and everyday practice are perpetuated by embedded cultural sensitivities. For example, what kinds of food are consumed is largely a function of income, which means that those who grow up in lower income homes are unlikely to know how to 'act' like the bourgeois, and, conversely, the bourgeois would have difficulty fitting in with 'common people.' As a result, the upper class see lower class taste as culturally naïve, and the lower class see upper class taste as pretentious (Bourdieu 1984). Thus, while corporeal capacity is mostly the same for all humans, they develop in different ways that lead to different understandings (Howes & Classen 2014, p. 9). Following this theory, grinders are already acted upon by the historically contingent social network in which they are embedded, even as they are changing the senses with which they experience and alter that same network. Thus, how grinders use their senses, how grinders enhance their senses, and even how grinders *want* to enhance their senses (whether they are successful or not) tells us about their sociopolitical location.

Having followed the grinder scene for over five years, in this dissertation I can offer a snapshot into the development of its sociopolitical trajectory and further theorize how the grinder body becomes socially inscribed. The influence of Foucault is unavoidable in this area, particularly with respect to his work on sexuality. As succinctly put by Lock and Farquhar (2007), Foucault's theories of sexuality have "made it difficult to stick to the standard biological sense of the word" (p. 384). Focusing less on the body itself, Foucault is instead concerned with how the sexuality of bodies is regulated, managed, and made to function (Foucault 1980, p. 24). His inquiry suggests a theory of power that links discourses and knowledge, the formations of which can be historically traced (Foucault 1980, pp. 12, 92-94). Briefly put, Foucault demonstrates how the proliferation of population data (*e.g.* birth, death, marriage rates) leads to the emergence of discourses around which norms are formed, thus making it possible for the body to be disciplined into conforming with those norms (Foucault 1980). These norms are historically contingent truths that seem natural, and so subjects govern themselves according to their currently 'appropriate' regime of health. Grinders, in line with their bio-determinist/constructionism hybrid, take a unique position on normalized discourses of health. On the one hand, at times they exaggerate what it means to be healthy by accepting 'normal' if only to order to surpass it (e.g. faster, smarter, better), and in doing so reify said regimes. On the other hand, they also seek to reject norms (especially medical norms) through bypassing or

undermining disciplinary regimes (e.g. the law, performance enhancing drugs). Thus, even though grinders resist historically dominant discourses of normality, they nonetheless frequently find themselves caught up in the disciplinary apparatuses that perpetuate these discourses.

Finally, talking about or using a body requires, obviously, *a body*. Everything may be caught up in discourse, but discourses of the body must nonetheless point to something material (Butler 1993, p. 28). For example, differences in gender are socialized onto the anatomical body (Williams & Bendelow 1998, p. 97), but these discursive differences have to relate to the physiology of the body in some palpable way. According to Butler (1993), the materiality of the body becomes known through "a process of materialization that stabilizes over time to produce the effect of boundary, fixity, and surface" (p. 9). She gives the example of how Freud's psychoanalysis brings into existence the phallus, which is both material and symbolic (1993, ch. 2). The symbolic element is an idealized form that makes possible interpretation and normalization (Butler 1993, pp. 62, 88). Here I return to STS to emphasize the importance of the material, technological body and sensory extensions of grinders. It is the very devices that grinders seek to integrate that produce new material and symbolic boundaries, which make possible new forms of performance (see Butler 1993). These new performances beget new modes of description, which allow for new possibilities of action (Hacking 2007, p. 158). In other words, changing the body will have far-reaching effects.

Making sense of grinders

This project is not about bioethical issues grinding may raise in the future. Though that is a relevant concern, this dissertation will demonstrate there are already enough social, ethical, and political controversies arising both from what has been already achieved by grinders, and also from the conditions that provoked grinding to emerge in the first place. Rather, this project is about what happens when the senses are placed at the centre of these controversies. How and why do grinders find themselves in the position of trying to modify senses? I begin to answer these questions in chapter two by examining how and why grinders want to challenge normative boundaries of the body. Rancière (2006) writes about how the junction between aesthetic (in the broad, multi-sensory use of the term) politics and political practices leads to disputes over the "distribution of the sensible" (p. 12), that is, disputes over who can sense what. For Rancière, these disputes arise from competing definitions of parts and positions within something that is

common to everyone. A clear example is who gets to speak, and who is listened to. Extending this argument, these disputes will only become more complicated if grinders challenge what is 'common' about senses.

Part of the reason this thesis is not interested in future bioethical issues is that grinders themselves generally consider these issues moot. If the technology is readily available for the 'average' person to modify their senses, grinders would argue it is inevitable. As such, questions like "*should* this be happening?" and "what can be done to *prevent* it?" are reframed by grinders as "*when* this happens …" and "what can be done *now*?" Bioethicists raise concerns about enhancements challenging the survival of the human species (e.g. Agar 2013; Annas, Andrews & Isasi 2002), but, from a grinder perspective, the species is already perhaps not doing so well. In chapter three, I examine why grinding has emerged as a semi-underground DIY movement by juxtaposing it with other entities one might expect to pursue sensory modification, such as universities and academic research, corporations and private industry, or established transhumanist groups.

Having explicated how and why grinders take the approach they do, chapter four then delves into some of their day-to-day practises. From a methodological perspective, at first this was difficult since grinders are geographically disparate, spread across the United States and Canada. When this research began, most grinders only knew each other online and had never met each other in person, though that slowly changed somewhat over the years as smaller groups began to cohere in specific locations. Internet forums and 'real life' gatherings seem to be closer to a 'scene' than a community in many ways, since the majority of grinders are transient in their engagement. Making this distinction is difficult as there is a lack of precision in the literature as to what exactly constitutes either community (see Cox 2005) or a 'scene' (see Pfadenhauer 2005). Merely 'showing up' was often enough to constitute belonging at grinder internet forums or meet-ups. In fact, while Lave and Wenger (1991) describe how newcomers are socialized into an established community, for grinders it was often the contrary: newcomers with 'naïve' or 'stupid' questions seemed to (re)socialize long-time forum posters by forcing them to reconsider what grinding should entail. Ultimately, I loosely characterize 'grinding' as a scene, or even a collection of overlapping scenes, that some grinders would like to turn into a community. Their struggles to do so are depicted in chapter four. Because of grinders' geographic disparity, the internet plays a prominent role in establishing sociality, discussing ideas, as well as procuring

materials. This chapter traces how their intentions and methods are mediated by online and 'real life' interactions, and complicated by the diverse purposes found within the scene.

Chapter five marks an analytical shift towards examining the sensory modifications themselves. Based on an empirical event of social manipulation and dissolution, this chapter weaves an epistemological discussion about modifying senses with methodological limitations. It seeks to understand the relationship between senses, sensibility, and social problems, both for grinders themselves as well as for myself as I try to understand grinders. It also develops much of the analytical language for the balance of the the thesis.

Chapters six, seven, and eight are case studies about devices that grinders have built, or are in the process of building. They each cover an aspect of a grinder sub-scene organized around magnet implants, RFIDs, and brain-computer interfaces, respectively. While grinders' projects are numerous, these case studies were chosen based on their ability to bring new sensory information into the body or create new ways of sensing the body itself. This eliminates the projects that solely make 'more' of a sense (e.g. to have 'stronger' mental performance, to 'increase' the visual spectrum). I decided on these three case studies because I felt these implants were the most promising for sensory and social rearrangement with palpable effects since they attempt to go beyond 'traditional' sensory boundaries.

Ethnographic methods

Given that the grinder scene is one marked by individual and geographic disparity, and because the outcomes of sensory modification are often invisible to observation, there were a number of practical and methodological challenges to carrying out this research. This presented an opportunity for methodological innovation using mixed methods, including a virtual ethnography and a multi-sited ethnography, which were connected by applying Actor-Network Theory (ANT) to trace the formation of socio-material networks surrounding grinders' implants.

Within Science and Technology Studies, the ontology of ANT makes no distinctions between physical manipulation and knowledge of the body, nor between the agency of human and 'non-human' (Law 2004; Mol 2002). Similar to Latour (1993, 2005), I applied ANT to demonstrate how sensory 'facts' are constructed through a series of mediations and intermediations made possible by a network of socio-material actors, evidenced by Internet

forum posts, observations, interviews, and other media. By 'socio-material,' I am referring to the hybridity of social and material ontologies that are co-produced by humans and non-humans.

ANT methodology follows the actors themselves to see how they order social assemblages by tracing their associations with thick description. From this description theory can emerge, but this is only possible by "working through the concrete" (Law 2008, p. 630). Though I will elaborate on how ANT is applied throughout this thesis, there are two concepts of ANT that are worth pointing out now. The first is *flattening*. Latour (1993) contends that "Nothing is, by itself, either reducible or irreducible to anything else" (p. 158). While networks of assemblages theoretically carry on infinitely, there are aspects of those networks that mediate the 'global' into the 'local' and vice versa (Latour 2005). For example, something like the broader international Transhumanist movement (with all of its members, buildings, websites, history, emails, etc.) is unevenly distributed across each person in the grinder scene, making it possible to explain how differing and contradictory viewpoints (or even the lack thereof) are made possible based on particular network connections. Moreover, flattening is inherently of import to senses, since the senses are intrinsically implicated on how the social gets flattened to the surface of the body. We can then ask, for example, how a particular grinder sees, hears, or even smells the Transhumanist movement. (This isn't to say that, practically speaking, reduction isn't taking place – this dissertation being a prime example).

The second immediately useful concept is *enactments*. Here I am referring to the ontology of ANT, which suggests that multiple realities are enacted through networks of object/subject hybrids (Latour 2002, 2005; Law 2004; Mol 2002). This allows the grinder's body, implant, and environment to be treated as an active assemblage of socio-material relations rather than a passive canvas for modification or significance. Enactments are ongoing constructions, the "continued practice of crafting" (Law 2004, p. 56). Grinders' enactments thus create new relations by bringing together objects that create new possibilities, or, in other words, by becoming a new assemblage of what can be considered a human body.

Data collection

Broadly speaking, instead of focusing on the practices of grinders (as it is difficult to define exactly who is or isn't a grinder), my strategy was instead to focus on the practices surrounding the implants themselves as both a socio-material outcome and impetus for social

rearrangement. For the most part this is tantamount to focusing on the practices of grinders, but it also allows some flexibility to include 'non-grinders' caught in the orbit of the grinder scene. I began with two sites – a grinder lab just outside of Tehachapi, and the most popular grinder website, biohack.me – and then worked my way outwards. These sites are interrelated and interdependent, so data overlapped in some ways and contradicted in others.

Official data collection began in January 2015 with a virtual ethnography of grinders' Internet forums to capture a range of data from forum posts, chat logs, screenshots, audio, and video (see Boellstorff, Nardi, Peace and Taylor 2012). The main site of investigation was the primary grinder hub, biohack.me. When I stopped actively collecting digital data in November of 2016, there had been over 1600 discussions, plus replies (I also continued to read and take notes in the year following, though less vigorously). Other websites of interest included a biohacker IRC channel, the Sapiens Anonym blog, and the grinder slack channel (see chapter 4), plus a handful of less active Facebook group pages. These websites are central to many of grinders' practices and experiences, both for how they connect grinders' offline activities and for how it allows users to imagine themselves without 'real world' obstacles (see De Mul 2010; Long 2013; Miller and Slater 2000). The Internet also creates a place where constructions of identity (see McDonough 1999; Turkle 1995), gender and embodiment can both extend the corporal and incarnate the textual (Sundén 2003).

Beginning in September 2015, I began supplementing the virtual ethnography with a multi-sited ethnography involving both in-depth interviews and 'real world' participant observation that would carry on into 2017. This type of multi-sited ethnography is "designed around the chains, paths, threads, conjunctions, or juxtapositions of locations," and examines the "circulation of meanings, objects, and identities in diffuse time-space" (Marcus 1998, pp. 79, 90). Formal interviews were conducted with 40 participants over two years (though most took place between May and November of 2016), and spanned 16 American states and two Canadian provinces. There were also dozens of informal interviews that occurred somewhat spontaneously at various grinder-related events, including (but not limited to) Grindfests Zero (March 2015), One (September 2015), Two (April 2016), and Three (April 2017); Defcon 23 (2015) and 24 (2016); and BodyHackingCon (also known as BodyHax) in 2016 and 2017.

My interviews were usually contextualized by ongoing relationships that lasted months or years. Only 15 of my interviews were with people I met only once, and the rest I had already

met in person at events. In fact, the 'formal' interviews often veered into other semi-formal or informal interactions, like going to the beach, drinking, and/or watching their kids. During these periods I was also able to observe grinders' laboratories and workspaces, as well as how they interacted with their families and friends, and, most importantly, used their implants in everyday situations. In order to continue many of our conversations and ideas after I moved to a new location, I often asked which grinding related websites they frequented (e.g. subreddits, news feeds, social media pages), added them to my daily internet note-taking regime, and would then follow-up later about any emerging related information.

A significant part of my fieldwork was spent at Jeff's grinder laboratory just outside the town of Tehachapi, California, site of the Grindfests. Jeff affectionately refers to the lab (which doubles as his home) as *Point Dume*, a portmanteau of 'doom' and Frank Herbert's classic book, *Dune,* giving it the air of science-fictional bombast. Over a couple of years, I accumulated about seven months at the lab and came to know both it and Jeff quite well. In fact, as time passed it became clearer to me that they were nearly the same thing – as one changed, so did the other. Every time I'd return to the lab (after travelling for an interview, for example), it was rearranged. The electronics workspace would be repurposed – maybe to become a depository for surgical tools – which freed up space for some new exercise regime, which required furniture to be moved outside, which would require rigging up tarps, and so on. One week there'd be a space for observing the stars, and the next week it had become an arena bound by electrified fencing for Taser-knife fights. And then a new project would start, or a grinder gathering would approach, and everything would change again. As a result, most the property looks like a mad scientist's garage sale. I recall one time when Jeff no longer had patience for a concrete fire pit he had built for Grindfest, so he let it roll down the side of the hill into a dried up ditch where it would be out of the way. A few weeks later he later wanted it again, and so I spent the afternoon slowly pushing it back up to the driveway while he was at work. A significant portion of the lab had been scavenged from somewhere and repurposed, making it both expendable yet also full of potential – a good metaphor, I think, for how grinders view their bodies.

Most of Point Dume's walls are whiteboards, which allowed Jeff to write down ideas immediately and elaborate on them in the ensuing weeks. These lists, sketches, journal citations, and blueprints would eventually become too messy or faded and be cleared, but in the meantime they also served to confront all of the lab's visitors with Jeff's current musings. Visitors were

welcome, and they were common. As will be elaborated on in the next two chapters, Jeff is a prominent figure in the scene not only due to hosting Grindfest, but also because he performs many of the implantation procedures. As a result, it wasn't unusual for the odd grinder to stop by the lab for a couple of days, and occasionally there were smaller gatherings. There was also fairly regular interest from documentary crews and journalists. At Point Dume, there is always something going on, and it is a prime site of cultural and socio-material production – what in the scene are are more commonly called *grinds*.

In summary, by building on (post)humanism, STS, anthropology of the senses, and sociology of the body literature, I aim to determine how grinders *make sense* in every meaning of the phrase. This includes, first, how grinders make sense of the world such that their bodies ought to become enhanced by setting out the social, discursive, and material conditions necessary for the practice of grinding to emerge. Second, it refers to to the actual act of making a sense – the brainstorming, designing, and physical development of constructing a sensory device. Third, it refers to how the world becomes flattened by the implant's ability to sense, or in other words, how grinders render their world sensible or insensible. Fourth, it refers to how implants enact a biopolitical assemblage that hierarchizes, describes, and makes sense both *for* the grinder, and also *of* the grinder in which the implant is embedded. As Haraway (1991) surmised, "a cyborg world might be about lived social and bodily realities in which people are not afraid of their joint kinship with animals and machines, not afraid of permanently partial identities and contradictory standpoints" (p. 154). She then emphasized the importance of understanding perspective of both sides, each of which with its own "dominations and possibilities" (p. 154). That is what I hope to achieve with this dissertation.

Note on Anonymity

Despite the openness of grinders – at least towards me – I should make a comment on anonymity. Some of the grinders I interviewed were far more willing to share than I am. Indeed, some of them were fine with telling me about their potentially illegal actions, which makes sense since many of them post openly about it online and have already spoiled their identity to some degree. Even though this information is already 'out there,' in this thesis I won't emphasize who exactly did what in certain situations. For this reason, throughout this text there are times when I refer only to 'a grinder,' and other times where I have used pseudonyms

or composite characters for the purpose of continuity or narrative. In contrast, there were also grinders who spoke to me on strict conditions of anonymity, even going so far as to require our communication to be encrypted. Finally, there were grinders in between who simply didn't want their name to arise in a future Google search, and so they've changed their name even though other grinders would likely be able to identify them from what they said. For any grinders reading this, I ask that you respect their privacy if you can identify them.

Chapter Two
Pre-emptive Body Enhancement

> *To intervene in the name of transformation means precisely to disrupt what has become settled knowledge and knowable reality, and to use, as it were, one's unreality to make an otherwise impossible or illegible claim.*
>
> Butler 2004, p. 27

Grindfest. The quasi-annual gathering of grinders held at a modest laboratory set-up in a crevice of the Tehachapi Mountains of California. Attending for the first time, Laird described it as a place "to do really fucked up stuff to each other in the name of friendship and bonding […] where we all come together and show real respect and compassion in light of our interest of mutually hacking each other open and shoving magnets into each other and doing drugs." It is an event where one can participate in or just observe the implanting of homemade devices into bodies, work on the latest projects, and experiment with the effects of chemicals on cognition and performance. Though there are calendar days that Grindfest definitively 'happens,' there is a mostly open invitation to extend it in either direction for those so inclined. Limits – corporeal, temporal, ethical – are challenged and occasionally broken.

Grindfests are an ideal place to begin an examination of how societal context gives rise to both ancient and emerging frailties of the grinder body. The methods are at times questionable, and the solutions mostly inadequate, but the questions are profound: questions of the body as illness, as racism, as sexism, as poverty, as a way of accessing and challenging perceptions of reality. And because these are serious issues, the questionable methods and inadequate solutions are accepted since they provide grinders at least some sense of progress towards understanding why and how the morphology of the body fits into networks of power and inequality. What draws people to grinding? And what is it exactly they want to enhance?

To begin answering these questions, I look to the social processes and structures animating the grinder movement by revisiting observations of Grindfests as well as interview data in order to bring out the centrality of vulnerable bodies to grinder's practices. By summarizing their views on the human body, I seek to contextualize their ambitions for human enhancement. This raises further questions with respect to how the body acts within an historical

context, with an emphasis on the corporeal materiality of the relationship between grinders' accounts of what a body *is* and what it *can or cannot do.* Along the way, I also get into some of the shared values and expectations within the grinder scene, and introduce the concept of pre-emption, which will play a larger part in later chapters. This chapter and the next set up the world as grinders understand it before they try to rearrange it with their implants.

What to do with your body at Grindfest

Though Grindfest is developing a reputation of being the 'Wild West' of augmented body modification (see Wortham 2015), it has modest beginnings. In March of 2015 the inaugural *Grindfest Zero* was quickly thrown together in an effort to demonstrate grinding as an actual 'thing' for the shooting of a hopeful reality TV pilot. Though ultimately the show was never picked up by media outlets, at the time Jeff was surprised by the positive response of the couple dozen attendees who showed up to his middle-of-nowhere location, not to mention a small outcry on the biohack.me grinder Internet forum from those who were unable to attend.

While Jeff and those involved in the pilot were filming in the detached garage-turned-laboratory, everyone else did their best to stay out of the way. Having only recently moved onto the premises, Jeff didn't yet have much furniture and so the rest of us sat on the floor in the adjacent house. Though I had already been following the grinder scene for a couple of years, all of the 'big names' from biohack.me were busy filming across the property, leaving the rest of us in a room full of strangers. Most were from the California region, ranging from San Diego to San Francisco, though others had flown in from as far as New Zealand. We found ourselves in an unfamiliar, remote location with no host to tell us the rules or set expectations about behaviour. The awkwardness was compounded by the ambiguity of not knowing what Grindfest was supposed to be exactly, or even what being a 'grinder' entailed.

Nonetheless, conversations slowly escalated and soon enough debates were raging about implantation techniques, NFC (near-field communication) chipsets, and the ethics of voluntary amputations. And like most good parties, Grindfest tested the limits of the body's tolerance for alcohol, though it would be a mere warm-up for other challenges to corporeal limits yet to come. When the TV filming ended, the time for experimentation arrived.

Jeff, the host and main organizer, tried to make a schedule, though he is also most likely the reason it didn't come to fruition as he excitedly bounced between ideas, conversations, and

conducting implant procedures. Many of the projects involved devices, terms, and acronyms I had never heard of. After the merits of having an RFID tag implant were explained over the course of a few drinks, the injector kits were produced and put into action. The effects of Ce6 eye drops were assessed for enhancing night vision. Magnets were installed in fingertips. An assortment of mostly legal or grey (and some darker-than-grey) market nootropic drugs were consumed. A TENS unit was hooked up to someone's nipples to see the reaction of both the test subject and their nipples. Celebrated cyborg Rich Lee tazed me, then someone else, then himself, and then we all held hands in a circle to complete the tazer's electrical circuit to shock us all at once – a sensory commodity "consumed en masse" (Parisi 2018, p. 56). There was so much going on, it was difficult to know when to closely inspect a bubbling substance in a beaker or when it is time to maybe take a few steps back. Inevitably, the party subsided (if not the swelling from one newly-minted cyborg's RFID injection), the incisions were closed and bandaged, and we passed out, wall to wall, in piles of sleeping bags across the floor.

At the very least, *Grindfest Zero* proved that grinding is more than a discussion on an Internet forum. Online, grinders' mottos evoke the need to enhance, improve, superlativize, and maybe (or likely) even replace the body. The biohack.me wiki declares: "Grinders practice functional (sometimes extreme) body modification in an effort to improve the human condition. We hack ourselves with electronic hardware to extend and improve human capacities." The mission statement of Pittsburgh grinder collective *Grindhouse Wetware* calls to "augment humanity". Jeff's blog is entitled "Augmentation Limitless." But what is the connection between these digital claims and the physical experiences, ranging from pleasure to pain, engaged in at Grindfest? What is it about body augmentation that compels strangers to drive into the mountains and have people they just met cut them open, insert a device, and stitch them up again? And not just once – subsequent Grindfests boasted a surprisingly consistent list of attendees. It has become a time of community, experimentation, collaboration, scientific method, education, debauchery, pain, and fun, often all at once. The online claims and the Grindfest experiences, I suggest, are indicative of grinders' dissatisfaction with the current state of the 'human' category, and in particular its relationship to how bodies work.

Considering the body as a means of transformation

For grinders, the body is potentially both the means and medium of transforming humanity. Grinders' interest in this relationship is similar to that of Judith Butler's in *Undoing Gender* (2004), wherein she considers the role of the body in social transformation. One of Butler's major themes is questioning the 'inherent naturalness' of gender by reconceptualising it as "improvisation within a scene of constraint" (p. 1), and then asking how we might 'undo' such societal restrictions to facilitate claims of body autonomy (in particular lesbian, gay, bisexual, transsexual, transgender, intersex, to name a few) (pp. 20-21). A fraction of grinder projects would even fall explicitly into this category. For example, a handful of grinders are exploring CRISPR technology for modifying gene expressions related to sex-determining hormones. Importantly, Butler (2004) reminds us that the outcomes of 'improvisations' are complex and therefore unlikely to be completely positive or negative. In the example of gene modification, it may be positive for someone transitioning from male to female, while others might be critical of entrenching sex characteristics in genetic determinism. Anticipating disagreements, Butler (2004) hopes to avert violent reactions by calling for a recognition of what makes our bodies mutually vulnerable, and, therefore, how our lives depend on each other. By identifying the power structures that constrain, it is "possible to overcome our formation, to break with that matrix that formed any of us as a subject" (Butler 2015, p. 9).

From what I observed at Grindfest, the mutual vulnerability of human bodies is where grinding begins, and grinders' experiments are where we can trace the networks of power that animate such vulnerabilities. And while only a few of grinders' projects are related to challenging gender norms, most concern another property of the body often assumed to be inherently interior or natural: sensibility. Grindfests are replete with examples of not only testing bodies to see what it can and cannot handle, but also reaching for new forms of agential sensibility by 'improvising within constraints.'

The balance of this chapter is an account of the relationship between grinders their bodies, as illustrated mainly through interviews informed and supported by observations at various Grindfests. The results broadly reflect two assertions about mutual vulnerability from grinders' perspectives: the body itself is inherently inadequate, and the body is becoming increasingly insufficient due to contemporary socio-material conditions. Though these explanations fuel one-another and are not always easily distinguishable, they are worth considering in turn.

The body is inadequate

> *Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones.*
>
> Donald Rumsfeld, 2002

In the summer of 2016 I found myself at a dinner party in Utah attended by a mix of grinders and non-grinders. The meal was a strictly utilitarian affair. Attendees served themselves pre-cut bread from a plastic sleeve, and kept the half-eaten slices directly on the table near their bowl of stew. The bowl itself was plastic, brought out only due to the unavoidable material challenges of containing liquids, and after it had served this purpose it was unceremoniously thrown away in a large, black garbage bag. And with the pomp kept to a minimum the conversation was maximized and continuous, where vigorous arguments and side-debates overtook one another amidst bouts of disagreement and laughter. In a roundabout way, somehow a discussion broke out about Donald Rumsfeld's political legacy, which inevitably led to a debate surrounding the significance of the above quote and the consequences of an unequal distribution of knowledge. Seizing the opportunity, dinner guest Rich Lee pointed out to me how grinding can be conceived as an attempt to resolve these three types of categories – known knowns, known unknowns, and unknown unknowns – as applied to the body's deficiencies.

I find these categories to be a useful heuristic device for thinking about how grinders perceive and approach the different kinds of inadequacies of the body for two reasons. First, practically, they provide a means of organizing the diverse types of projects. Second, and more importantly, they highlight how grinders have a strong predilection for relating vulnerabilities of the body (and ultimately, as we will see, concomitant social problems) to perceived epistemological deficiencies. The vast majority of grinder projects target perceived weaknesses in the sensibility of the body. Some are obvious and specific, while others are abstract and

perhaps reaching, but all of them are derived from questions about what can be known and what it means to know.

Known Knowns

Grinding is the pursuit of achieving maximum ability. To grinders, the given body is weak; it must be diagnosed, fixed, reinforced, and improved. The complaints made by grinders were numerous. The body wears down. It is bad at moving fast, at controlling pain. It is inefficient at regulating heat, at consuming and using energy. Its skin is inadequate at adapting to heat or cold. It performs poorly when electrocuted. It is not bulletproof or even bullet resistant. It uses the same pipe for breathing as it does for eating, leading to unnecessary deaths by choking. Its memory is unreliable. Its intelligence is not distributed (unlike, say, an octopus'). It gets sick and old. And, above all, it dies. Everyone's body is unacceptably fallible. "This body," summed up Marc, "is bullshit and we need to fix it or improve on it or make it hardier." Marlo further expressed his dissatisfaction, arguing "it's not really great at doing math. It can't survive long in a vacuum. There's a whole bunch of things it just fucking sucks at." Whereas most people accept these underlying assumptions of the body – the known knowns – as static givens, grinders take them as things we sense that we would rather not, and maybe don't have to. To feel healthy, you need to eat a balanced diet and exercise? Not necessarily, says the grinder, who might look into alternative meals such as soylent, electrical muscle stimulation such as TENS units, or even unconventional bodies such as uploading your mind to a computer or brain computer interfaces.

Such 'known knowns' are relatively 'low-hanging fruit,' in the words of Max, which produce promising grinds based on existing research. Take Max's work on myostatin inhibition, for example. Mystotatin is an amino acid related to the catabolic limiting of muscle growth. In other words, reducing its effects will result in becoming a muscle-bound freak with little effort. If Max succeeds, myostatin inhibition would not only make him a lot of money, it will also change the pursuit of 'health' and what it means to exercise. I asked him if he would take it himself, and without hesitation he answered, "Oh, dude, yeah. I'm way too lazy to work out. These people who spend hours every day in the gym, they're taking their branched amino acids and watching their fucking ratios on their shit. Like, no, dude. Just pop this stuff in there." To me, however, Max seems far from lazy, spending his free time researching and grinding in

addition to his fulltime job in the bio field. In a way, grinding is itself a form of exercising that follows a different temporality wherein physical labour is substituted with mental labour. The former requires engaging in repeated brief activity for a lifetime (e.g. going to the gym), while the latter requires an extended period of activity (e.g. research) that will one day hopefully render certain physical and mental labour obsolete.

For grinders, that the status-quo of health is inherently inadequate comes down to what is considered an insufficiently evolved or designed form. These deficiencies are blamed for a lack of overall technical progress, as well as the proliferation of social inequalities. As it was explained to me, it is our weak bodies that keep us from living in extreme situations, and that is why we cannot survive in the desert, live in the ocean, or fly into space and live on Mars. Because bodies work well only in certain conditions, they are limited by narrow parameters of heat, oxygen, time, et cetera, which then leads to their uneven distribution over geographical spaces and limited lifespans, which in turn contributes to the underlying conditions of most social problems from the personal to the geopolitical. If the body is, as Synnott (1993) puts it, "the prime symbol of the self, but also of the society" (p. 4; see also Canter 2002, p. 61), then the shortcomings of a body would also represent failures well beyond its corporeal limits. Questions about distributing resources, time, space, and material are mutually contingent with the fallibilities of the body.

Being 'healthy' is rarely enough for grinders because it doesn't change the relationship between the body and the conditions imposed upon it. Instead of merely managing weaknesses, they endeavour to face them head-on. I suspect this is part of the reason grinders are voluntarily shocked by Rich's homemade tazer – to be confronted with our shared precariousness. To avoid the tazer is to ignore the extent of the problem, to pretend like everything is okay. (Rich has subsequently conducted experiments to make him impervious to tazers). The known knowns of body frailties affect every part of everyone. Therefore, no *body*, whether in part or in whole, is beyond potential replacement or enhancement. Grinding is a reaction to and rejection of the perceived status quo.

Known Unknowns

Beyond these universal body deficiencies, many grinders also cite individual cases for modifying the body to account for things that are known to only to select people. Within the

grinder scene there are many examples of such afflictions, including auto-immune disorders, debilitating allergies, and lactose intolerance. Each of these conditions provides an awareness of surroundings that others do not share (e.g. the presence of pollen). Unlike the universal deficiencies of the known knowns, however, individualized weaknesses of the body underline the notion that specific properties of bodies are capable of difference, and therefore (they presume) also modification. When a body exhibits 'un-normal' performance, it identifies locations for intervention.

For example, Justin A is a 'supertaster.' He has a genetic predisposition allowing him an enhanced gustatory pallet beyond what most people can taste. Unfortunately, it is not a pleasing flavour.

> So I got a gene that lets me taste things other people can't. I wish it was a more entertaining set of tastes rather than everything tastes like ass, but, you know, whatever, it's there. But if there's that, there's got to be something else. What if we can turn on whole new flavours? What if we can truly fuck with the senses? (Justin A)

Jacob's visual impairment leads him to a similar conclusion:

> I'm colour blind, or red-green colour-blind, so I suppose it's possible that being aware that there were things in the world that I wasn't experiencing kind of was just part of my interpretation of the world from an early age. And so I already kind of knew that there was stuff right in front of me that I wasn't able to see or experience […]

Bodies that perform outside of the norm reveal the existence of the known unknown, that is, things we know *are* sensible, yet they are not sensible to everyone to the same degree. Once it is a matter of degrees it then becomes a question of making knowable the entire spectrum of degrees and pushing those boundaries. For example, a longstanding unfulfilled grinder goal is to develop tetrachromacy by extending the perceivable visual colour range to four primary colours[3].

[3] See, for example, Deeb 2005; Ingling Jr 1969; Jordan, Deeb, Bosten & Mollon 2010.

While visual and gustatory sensations are more overt examples, it is also possible to consider sensory extension to smell carbon dioxide or other threats to the body that we are aware of yet are unable to make direct, immediate sense of. In other words, there are things that are knowable, even if existing human senses cannot pick them up: What does the fourth colour look like? What does carbon dioxide feel like?

What do known unknowns tell us about mutual vulnerability? *Theoretically*, grinders' interest in these 'super-abilities' might shift what was previously considered 'able' to the category of 'disabled' by comparison. According to Mitchell and Snyder (2015), in the contemporary neoliberal era, 'worthy' interventions of the disabled aim for inclusion in consumer culture, a culture which I note grinders are fully capable of accessing and therefore are unlikely to garner much sympathy from the general public. Yet questions of what counts as 'disabled,' 'impaired,' or 'healthy' are fraught with political contestations that are based on social and biological context (Browne & Millar 2016; King 2017; Timander & Möller 2016), and also material conditions (Feely 2016). That grinders wish to *exceed* implies that the 'norm' itself is – at least to them – already to some degree disabled, thus highlighting a wide-ranging mutual vulnerability since 'we're all in this together.' However, this is not the only possible perspective. Goodey's (2016) deconstruction of 'learning disability' argues it is a product of a general social phobia, and that the phobia itself is a more appropriate target of intervention than the supposed 'disability.' From this second perspective, the broader grinder project might dispel the phobia of known unknowns. In other words, it is not about the disability of being 'normal,' but rather about dispelling the myth that humans should have to aspire to 'normal' to facilitate inclusion. By being different, they hope to undo exclusionary norms. A third perspective, however, is less hopeful. Advocates of human enhancement might argue altering the aforementioned parameters of the body would undermine the possibility of exclusion on both social (e.g. a 'colour-blind' pilot) and material (e.g. from areas of high pollen) grounds. If this were to actually become possible, however, it would also likely shift the onus of exclusion back on the person who does not 'take advantage' of such a modification, returning us to Mitchell and Snyder's critique.

Practically, the outcomes of pursuing enhancement are even more complex. As evidenced in the chapters that follow, they are not limited to these three perspectives, nor are they as clearly delineated. The concept of disability is "profoundly relational" (Ginsburg & Rapp 2013, p. 54), and impossible to avoid when discussing human enhancement. I will expand

on these issues as they arise in specific grinder projects, but at their core, the known unknowns of body potential attempt to take what is different and then amplify ability to super-ability.

The Unknown Unknowns

Beyond working through universal frailties of the body, and challenging notions of normality, the greatest obstacle to grinders is the uneven distribution of ignorance; that is, the pursuit of unknown unknowns. Beyond the known knowns and known unknowns, grinders are also mindful that the body may have capabilities or weaknesses of which they are unaware.

In April, 2016, I attended Grindfest Two: *Altered States*. Its tagline betrays the grinder love for wallowing in unknown unknowns. Without naming names, at one point about half of the attendees started up a game of *Secret Satan*. The rules of Secret Satan are similar to the classic jovial Christmas game, Secret Santa, where participants draw names out of a hat and then bestow an unlabelled gift upon whoever they picked. The main difference is, instead a receiving a gift, in Secret Satan you are assigned a video to watch after being strapped into a body bag fastened to a chair Clockwork Orange-style while tripping on salvia. Salvia, also known as 'sage of the diviners,' is a smokeable psychoactive plant commonly associated with unpredictably bad trips that, although in reality only last a few minutes, for the affected person seems to last forever. A few considering participating in Secret Satan had previously experimented with salvia, recalling unpleasant experiences that they would not care to repeat … except maybe just this once. On the surface, finding out whether 'Satan' had chosen a pleasant nature documentary or a violently confusing arthouse film serves as a community-building exercise. The participants bonded by exposing their mutual vulnerabilities, and facing these vulnerabilities head-on challenges normative notions of human morphology by disrupting what has become "settled knowledge and knowable reality" (Butler 2004, pp. 23-27, 34-37).

Later, at Grindfest Three, further tests of corporeal vulnerability included scarification, waterboarding, and electric knife-fighting. While some participants seemed to enjoy the inevitably painful and disquieting sensations of these trials, another purpose was confronting the experiences that social institutions have traditionally protected us from. After waterboarding, for example, there were discussions about what techniques or devices might counteract the unpleasant effects. Though I didn't bring it up at the time, I noted to myself how we were in a country that had admitted to using waterboarding on prisoners, and wondered what significance

that might have on our decision to try it. Indeed, it is ironic that Donald Rumsfeld's 'unknown unknowns' speech was justification for torture and other 'enhanced interrogation' techniques for eliciting evidence about weapons of mass destruction. (In other contexts, some grinders told me they were apolitical, while others were unabashedly anti-government).

Most people admitted participating simply to see what it was like. Some who thought they would last minutes made it only seconds, and others who thought they would give up right away made it much longer. Though in other contexts some scholars have decried these transgressions as dehumanizing (e.g. Scarry 1985, describes it as the deconstruction of civilization for both torturer and victim; see also Green 1998), for grinders it was educational step on the path to trans- or post-humanism. The waterboarding experiment was never a competition; participants were neither chastised for doing 'poorly,' nor even commended for trying[4]. Unlike the electric knife fights, which evoked excitement and motion, during the waterboardings the participants and observers took a far more somber tone. Certainly, it was not torture in that nobody was truly vulnerable; the waterboarding was stopped as soon as the participant voluntarily dropped a baton. However, grinders' interests in participating were driven by an acknowledged naivety that comes from their position of privilege. While there was an element of what I consider to be 'cowboy machismo,' the underlying intention was to expose their own naivety about the boundaries of bodies, if only to a small degree. For me, the experience was as uncomfortable as it was interesting. Frankly, I lack the vocabulary to properly describe how it felt, though it did provide insight into what it means to pursue unknown unknowns.

Beyond community-building, the exercises of pseudo-torture, pain, and drugs suggest a deeper operative logic by confronting participants with the possibility of a world not how it appears, and that perceptions can be unexpectedly changed and exploited. As a scene, these activities are an act of grinder sociality, but as individuals they also demonstrate the importance of discovering unknown unknowns to confront what (or who) exploits the exploitable; to find out what you are capable of, and therefore what others are capable of doing to you.

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[4]The electric knife fighting, however, was overtly set up as a competition, though its underlying purpose was more about community building and having fun rather than testing the limits of the body. After all, most of us had already shocked ourselves with the knives before the competition began.

The operative logic of pursuing unknown unknowns leads to what Massumi (2015a) calls the 'logic of preemption.' Massumi develops this analysis directly from Rumsfeld's 'unknown unknown' quote referring to the existence of weapons of mass destruction in Iraq, and I suggest it applies equally well to grinders' pursuits. Where corporeal known knowns and known unknowns are defined by external ontologies of the body (e.g. material weaknesses, or abilities that can be assessed empirically), unknown unknowns require combining "an ontology with an epistemology in such a way as to trace itself out as a self-propelling tendency that is not in the sway of any particular existing formation but sweeps across them all and where possible sweeps them up in its own dynamic" (Massumi 2015a, p. 5). In other words, intervention precedes ontology, and therefore threats must be preempted before they are fully understood. It is better to find, test, and understand the limits of the body so you can determine the result before someone/something else raises the issue. It is not just discovering the body's reaction to, for example, waterboarding; it is discovering the body's reaction to what it has never experienced.

According to Massumi (2015a), within a logic of preemption, "For a future cause to have any palpable effect it must somehow be able to act on the present," and this is achieved by "translating the imminent *threat* into a clear and present *danger*" (pp. 6-7, emphasis original). Yet where Massumi's logic of pre-emption arises from the political uncertainty of the United States' war on terror, for grinders it is spurred by corporeal ontological insecurity. What grinders hope their bodies will be in the future is the motor driving what they do to their bodies in the present. In this way, grinders' experiments can work simultaneously in opposite temporal directions, both finding deficiencies *now* to fix *later*, yet also operating according to a logic that their *future* bodies will benefit from how they destroy in their *present* ones. In other words, they bring about the very risks they hope to avoid, such that they may become avoidable (e.g. a fear someone will waterboard you is pre-empted by waterboarding yourself first). Activities like Secret Satan or waterboarding direct a way of progressing towards an uncertain body that is neither fully formed nor even yet emerging. Though not always as painful a form as waterboarding, this logic is present in grinders' projects of sensory enhancement as covered in chapters six through eight.

Working through unknown unknowns

Preemption occurs in the present. While some grinders can be individually reckless, as a group they work together to find ways of mitigating risks. For example, there are many reasons Point Dume is used for experiments and Grinder meet-ups, not the least of which that its owner Jeff is an ER nurse who, as much as he jokes about everything, takes his job and its ethical responsibilities seriously. He does not tell people what to believe, what to do, or what not do, but he will do his best to help keep them safe and inform them of risks. If someone is trying a new drug Jeff will keep an eye on them, and might even help them have a good time while they are at it.

Moreover, it would be a mischaracterization to claim Jeff is 'just' a nurse, as he is continually expanding his medical acumen beyond his role at the nearby hospital by keeping abreast of emerging medical discoveries and procedures. I don't know that there is anyone else in the grinder community that has garnered as much respect and trust, or who is called upon more often to give opinions on a wide variety of topics, such as (hypothetical) administration methods or post-operative care. Though he admits to finding this attention and reputation unnerving, in my opinion he earned it by being clear about what he does or does not know, and by demonstrating a willingness to look further into scientific and/or historical literature and share his knowledge.

This pedagogical proclivity of Jeff's is something I witnessed many times. Once, while at the lab, I was minding my own business when he burst into the room and, unprompted, began quickly telling me about how muscles work on a cellular level. I can't reproduce his surprise lesson with any accuracy but to my recollection it involved a technical explanation of how actin and myosin and sarcomeres get 'all fucked up' in the process of muscle contraction, which involved a worm analogy (complete with appropriate demonstrative finger motions), leading to some new grind he thought might be possible. Most of the time his explanations are clear and exhaustive, but the grander the idea the more excited he gets and the quicker he talks, and I am reduced to hanging on for the ride.

Someone like Jeff is important to grinders who pursue the unknown unknowns. First, he is an example of grinders looking out for one another and sharing information, which not only reduces unnecessary recklessness but also redirects necessary recklessness in manageable, productive directions. Second, because a lot of the unknown unknown ideas tend to flow through Jeff at one point or another he acts as a knowledge repository, a sort of Google search

engine for when you don't know what terms to use. Because many grinders have no formal training in any field, there is a need to identify the unknowns of projects, the things that they could not have thought of that might go wrong. Even those with expertise need interdisciplinary and experiential knowledge. An expert on batteries is not an expert on batteries under the skin, is not an expert on implanting batteries under the skin, is not an expert on removing implanted batteries from under the skin, is not an expert on disposing of batteries contaminated with biohazardous material, and so on. When grinders are toeing the unknown, they rely on others like Jeff. But Jeff does not know everything, and not everyone knows Jeff.

Looking for unknown unknowns

Indeed, the most difficult part of unknown unknown grinds is trying to know what you don't know. Given their ambiguous nature, they are often difficult to articulate clearly. I noted two main ways grinders find unknown unknowns. One is unintentional, where unexpected or unintended outcomes from an experiment. The other is a method of inquiry to simply 'see what happens' without a specific goal in mind.

With respect to unintended consequences, one method is to see what unknown unknowns turn up by pushing limits. One group of grinders discovered this when trying to push their visual acuity into the near infrared (NIR) range by consuming a strict modified soylent diet devoid of vitamin A, and then supplementing with vitamin A2. When the participants were forgetting to eat, they soon realized that vitamin A may also be crucial in the body's hunger mechanism. The team (which included a biologist) was unable to turn up any research on this, demonstrating how testing the limits of the body in one way can reveal other unexpected limits.

As a method of inquiry, looking for unknown unknowns is its own reward, where elements of playfulness and discovery might outweigh specific 'scientific' objectives, as was the case in Secret Satan. For Jeff, any project proposal with uncertain outcomes is tempting. When he says 'I don't know,' it is a near guarantee his next thoughts are how to find out. Likewise, for Drew and Anita it is just a matter of following through, asking "is this bad? No? Let's do it. Like, it's not good necessarily, but it's not bad, either" (Drew). Anita echoed this philosophy: "Why not try? Like, rather than writing [something] off and saying it's impossible." The two of them followed through with a carotenosis experiment, partially to see if eating eight or more

carrots a day would turn them orange (which it kind of does), and partially just to see what else would happen.

Having unknown unknowns turn up while grinding may be a side-benefit, but looking for unknown unknowns themselves is a trickier endeavour. How does one go about imagining the un-sensible? Jacob uses his experiences with magnet implants to extrapolate the possibility of unknown unknowns to an alternate present: "We're only seeing a little tiny sliver of reality and most of the world exists beyond what we're capable of perceiving, and this [magnet implant] gives me, you know, just expands -- helps me appreciate the depth of our blindness."

Part of imagining the un-sensible involves considering its effects and what could happen if more unknowns become accessible. For example, it is possible to extrapolate future possibilities by applying present technology to the past. Rich Lee considers what might be if humans could see heat:

> Say our ancestors had the same ability and they saw somebody who was super warm because they had a fever. You know, they might just quarantine them and let them die [...]. Would we have avoided the plague or different plagues? And would our population be out of control right now? Or would it be the case that our immune systems would just really suck because we weren't exposed to as many diseases now. […] It definitely would have dramatically altered our development as a species. It's interesting to think about how it would have changed history completely.

Rich's hypothetical scenario implies is that by making new sensibilities, the outcomes of grinding might change or even control the future, for better or for worse. Rich's imagination of the effect of body enhancement on the present is supported by others who find general hope in discovering new forms of sensibility.

> So one of the things I feel like that's wrong with the world is we've filled it up, and so we're in this shitty in-between period where it's like there's no new land or continents to discover but yet we can't go out to the stars and find planets and stuff. So it's like if we're not going to be able to do that any time soon, why don't we start exploring our bodies and exploring how far we can push human limits, you know? (Jordy)

> I think it would be great to see or feel just the stuff around us, because there's all this information that we're missing. I mean, think about it. Like 90 percent of the universe is dark matter and we have no way of interacting with it. It would be cool if we could interact with all the shit that we can't see, because at the moment we're missing a whole bunch of information and I think it would be interesting to see what you can do when you have access to all that. (Justin A)

If, as grinders would have us believe, all bodies are simultaneously inadequate and yet full of untapped potential, then why is the practise of grinding appearing now? What pressing social conditions exist that compel grinders in particular towards a pre-emptive logic of body enhancement? We can find insight into these questions through an analysis of the second category of body weakness, that is, that the body is inadequate due to changes in socio-material circumstances.

Bodies, increasingly insufficient

While grinding may be based on mutual vulnerabilities of the body, these vulnerabilities are not evenly distributed by space and time. I am not arguing (nor do I suspect any grinder would argue) that grinders feel these vulnerabilities the most. However, because grinders are neither very vulnerable nor very privileged, their projects are positioned to expose power structures that may benefit the disproportionately vulnerable. In particular, by attempting to modify sensibility they provide insight by critiquing the sensory dimensions of social problems. It is my hope that this information will benefit those who are more vulnerable, or that lessons can at least be learned from grinders' mistakes. At the same time, as will be demonstrated in future chapters, despite grinders' good intentions their efforts may also work to others' detriments.

The balance of this chapter attempts to position grinders spatially and temporally by examining their perception of the relationship between past, present and future. How do hopes of as-yet-undiscovered information/technology act on the present? Unlike the weaknesses that have always plagued human bodies, this second set of fallibilities concerns recently emerging socio-material conditions to which our bodies are maladaptive. "We're not like our great-great-great grandfathers who were fighting off bears, or like *The Revenant*," says Jordy, conclusively

adding that “Humanity's not like that anymore.” Marlo makes a similar assessment: “Right now we've got a brain that's really good at doing monkey things, like it's good at, you know, fighting, fucking, and feeding. It's good at keeping you alive on a Savannah. It's not really super great at co-existing in society.”

What is it about current society that has changed? Grinders cited numerous concerns about socio-political and environmental problems being increasingly insensible, while at the same time evoking a strangely optimistically pessimistic view of the world, and particularly the USA. The pessimistic aspects draw mainly from a perceived inability to affect the trajectory of global afflictions. Speaking from Southern California, Max gives his prognostication.

> I would say [it’s] more a race against the inevitable collapse of industrial civilization as it relates to fossil fuel usage and -- yeah, I'm sure we could put up some solar panels and shit, but it's not going to feed nine billion people and keep them at the standard of living. Close [to] the standard of living. I'm sure we'll mutter through it -- or, muddle through it at the end of it […]. I take a pessimistic view of technology. I mean obviously technology's great and I love it and I spend way too much time on the internet and all that stuff, and I love computers and all the other fancy shit that we can do in bio now, but I just mean that I'm pessimistic about its possibilities, the promise that was there from, you know, the thirties through the -- up to today, really. Since the seventies nothing's really gotten better except computers, and while they've gotten super great I think it's masked a lot of the systemic problems that most of our energy still comes from fossil fuels and all the hydro power's been tapped out. (Max)

Their forecast seems dire, but most grinders are hopeful they possess the agency required to overcome their own predictions. While sitting with Jordy on his back porch in Lancaster, California, a drone buzzes in the night sky nearby. He tells me it monitors “traffic” for “emergency situations.” Maybe he’s used to it, but for me it is unsettling to be surveilled while at home. Jordy mentions his hopes that biohacking might bring about positive political change. When I ask him if he can elaborate, he pauses. “I need another cigarette for that.” After lighting one up he launches into a recitation of recent events that contribute to his perspective on the trajectory of America: the recent injustices surrounding the Black Lives Matter movement,

including shootings caught on film; the Dallas police robot that delivered an explosive to kill a shooter; accusations and anecdotes of voter fraud in the presidential election primaries; pollution and meth-head migration patterns in the greater Los Angeles area; jobs being lost to automation. For Jordy, few things about the future seem certain except that "technology is going to keep advancing." He puts his hope in modifying bodies so they can stay competitive. Though he never explains how modifying bodies might help Black Lives Matters or voter fraud, he does give an example for coal mining: "You know, you never know when there's going to be a natural gas leak, which you can't smell because you're so deep under the earth and it has no scent. So what if we did have something that was like the photosynthetic algae that was in your skin to where all you had to do was turn on a UV light and you can still keep going and getting out of the tunnel?" Interestingly, Jordy's assessment of the situation involves keeping the political system essentially intact, with any 'change' coming from acting on the body itself.

Whether technological survival or political survival, grinders repeatedly decried how changes in the body have not kept pace with those of society. Bodies are the "product of a messy evolutionary process" (Anita), and "not a good product" (Max), at that. TrybalWolf argued "we live in a different age than our biology was meant for […]. Just like technology becomes outdated, I feel biology – I feel certain aspects of personality, certain aspects, certain drives can also be outdated." With little political power, grinders turn to biohacking bodies as a means to "hedge your bets, prepare yourself" (Max).

Part of this pessimism stems from the confronting the cumulative deleterious effects of irreversible decisions made long ago. Evan draws from personal experiences to connect the past, his view of the future, and his immediate circumstances:

> [We have] this just incredibly advanced technology, and our bodies haven't changed since we were hunter-gatherers. […] We've moved so far forward in what we do, in the artificial worlds we constructed, we now have to make technology to adapt us to the worlds we've made as opposed to -- so I think so much of human history has been engineering things so that we can live within the natural world or so that -- not within, really, but to lessen the dangers of the natural world, and we've gotten to the point -- and I don't think this is a recent thing, but we're now having to combat even more and

more and more the dangers of what we've created because our bodies can't. Our bodies are amazingly resilient but also surprisingly fragile at times.

[…] I mean, part of it I think is just kind of, I don't know -- ironic? Is that the right word for it? It's kind of humorous, especially when people talk about, I don't know -- I mean, I think the body is incredible, but […] I wonder about what kind of effect it has on people, the fact that we're essentially living in an environment that we were never designed to live in. I don't like what the word designed implies, but essentially it's not what our bodies are well-adapted to. And it's just -- I don't know. You look at something -- even something as simple as, like, at my work people talk about what the best shoes are because they're on their feet on concrete for eight hours a day. And you know, people aren't built to stand on concrete for eight hours a day so we have to make more things to make us able to stand on concrete for eight hours a day. And I guess to tie it into biohacking, it'd be nice if our bodies could just deal with it because we are, as a society, as a culture, technologically accelerating. I think we always have been, but even now just so much faster than our bodies can adapt to. I mean, you look at the process of evolution and stuff, it's incredibly slow compared to the process of urban planning or cell phone development. And at a certain point I think it's going to be necessary to step in. I mean, we already are, but you can either do it internally or externally, you know? You can either make a space suit or you can redesign your body to be able to survive in space.

[…] I know me, personally, and some people I've talked to are participating in getting implants just because somebody needs to do it. It needs to be moved forward. And I think we'll get to a point -- if you look at climate change, which I think we're kind of past the point of no return on, you can shut down all the coal plants you want and stop all of the cars in the world. I think we're still screwed to a degree. I think it may come to a point where it will be legitimately better to make people naturally adapted to higher temperatures in different environments than it would be to just invent clothes that keep you cool or something, you know what I mean? I think we're going to definitely be getting to a certain point where it's just more useful to modify the human body either through technology or just genetically and have it pass down than it would be to invent external things to try to control our environment.

Q Can you think of other things that maybe we haven't adapted to?

A Radiation.

Q Okay.

A And carcinogenic materials. I mean, that's the big one for now. I think about diseases, but then a lot of these things like cancer and Alzheimer's and stuff are what people call diseases of age where we'll fix them, people will live another ten, 20 years, and we'll find some new things that are stopping us.

It's hard to think of what's the biggest thing we haven't adapted to. You have obvious stuff, like we haven't adapted to being hit by a car going 30 miles an hour, which would take a lot of work and it's a lot easier to just not run into the street. As far as trying to think of things that are in our environment constantly, I mean, that's kind of the biggest thing that always comes to mind is just hazardous chemicals especially. You look at things that are carcinogenic that it's in your body and it's not going away.

So I think if there's anything I could say it would just be being to process foreign materials better. Like, from working at a machine shop I have silica in my lungs. It's not going away. Ever. Like, it's just there now. And thankfully I don't have enough to cause any problems, but for people who have worked in that environment for a decade, silicosis is a real thing. You know, it's a real risk. And the only way to get it out is to cut the lungs open and pull chalk chunks of what's essentially chalk out of the lungs. And I mean, you've got other stuff, too, things like heavy metals and stuff that just kind of hang out for a long time until the point where it starts making you really sick and then you can get it treated.

So I think if we were built to process things like that a little better, things like even in an area like this [Los Angeles], you know -- dust. It's surprising how much -- especially on a day like this -- how much dust is actually in the air. I used to bike around here a lot. You can feel it when you start breathing heavily. (Evan)

I have left Evan's quote almost entirely intact to demonstrate how overwhelming the disconnect is between the capability of his body and what is now asked of it, as he jumps conceptually between the shoes on his feet to economic realities to worldwide disorders and then

back to the crud in his lungs. The presence of xenobiotic (i.e. foreign) chemicals in the body in particular underlines how social problems become biological problems that challenge the taken-for-granted boundaries of the body (Guthman & Mansfield 2013; see also Jackson & Neely 2015; King 2017; Parr 2002). From grinders' accounts, it seems there are few choices available to successfully cope with the environment that don't require some form of corporeal intervention. Merely being alive in current conditions amounts to a form of impairment, resulting in mass body *dys-appearance*, to borrow a term from Leder (1990).

For Leder, the materiality of the body is for the most part in a default state of 'corporal absence,' and we only come to perceive it when it is disrupted by pain, strong negative emotions, or other kinds of interference (p. 84). Dys-appearance thus occurs when there is a *dys*function that causes the previously absent body to *appear*, causing a person to reorient themselves accordingly through action (e.g. pulling a rotten tooth). Leder was particularly interested in social dys-appearance, that is to say, when the gaze of an Other makes you aware of your body's perceived shortcomings. Certainly, the activities at Grindfests play a role here. However, what grinders like Evan describe goes one step further: a dys-appearance of the body resulting from the unavoidable conditions in which it is forced to exist. It takes the form of aggravated lungs, increasing SPF lotion requirements for sun exposure, or hunger due to unemployment.

What is to be made of the grinders' pessimism about the socio-political problems and their (perhaps reserved) optimism about technological individualistic solutions? When confronted with complex, polymorphous socio-environmental problems like Evan describes, Murphy (2006) suggests we can start by looking at how they are physically connected to the body as assemblages, and then ask about the problems themselves. Indeed, that is how some grinders approach their projects (see in particular chapter 5), and it is this approach I am most interested in. What are the present effects on the body of such a projected future? How do grinders disassemble and reassemble the assemblages in which they are entangled to pre-empt social problems, and how does their future-present disability challenge "lifelong presumptions of stable identities and normativity" (Ginsburg & Rapp 2013)? According to grinder logic, the solution is to pre-emptively change what life *is*.

Future-present bodies

When considering the diversity of not only grinders' projects but also their backgrounds and individual goals, I found no consensus about what a body *should* be, but only *that* bodies *could* be. But therein lies an unavoidable tension. On one hand, the grinder body is regarded as neither inherently sacred nor profane; indeed, they frequently refer to it as a *meat-sack*. On the other hand, the body's materiality is where experiments and decisions take place. Transforming the meat-sack will presumably have positive social effects, even if it merely becomes a new kind of (enhanced?) meat-sack. Moreover, despite being 'just meat,' treating the body as such could result the inability to continue grinding due to a debilitating or fatal injury. So, despite grinders approaching the body as being completely replaceable (and for some, even obsolete), it is also limited by the capabilities of the body itself.

This tension remains present in every grinder project, bound up between romanticizing the unknown and their fleshy realities, even if the latter is below surface appearances. Indeed, the sombre tone that some grinders derive from the uncertainty of their socio-material circumstances only came out during interviews. At Grindfest and other meetups, the atmosphere has always been an optimistic one of technological possibilities and productivity towards pushing the limits of the future-present meat-sack. They consider their current bodies, to borrow words from Stelarc, "merely the convenient access to a body for particular events and actions," an "impersonal evolutionary, objective structure" (in Atzori & Woolford 1997, p. 196).

In summary, to grind is to pursue body augmentation by reacting to the known knowns, being proactive about known unknowns, and in particular operating on a pre-emptive logic towards the unknown unknowns of the body and its relationship to the world. But this rubric does not capture the entirety of grinding. As Žižek (2004) points out, there is one more category of knowledge that Rumsfeld overlooks: the unknown knowns. He describes these as what we refuse to acknowledge we know. In other words, there are constraints to improvisations, even if grinders operate under the assumption that anything is possible. As the balance of this thesis will demonstrate, pursuing body enhancement as the nexus for change has complex effects, as agency conflicts with a public dimension where "my body is and is not mine," and "'doing' and 'being done to' become equivocal" (Butler 2004, p. 21).

Chapter Three
Grand Theft Future

Summer 2016. I'm driving with Jeff through the Mojave Desert to scout locations for Grindfest Three: *The Nature of Man*. By his estimation we're going to need somewhere with more space and freedom to pull off a larger event, possibly with explosions and excessive bubble machines. He suggests the bubbles will be laced with something yet to be determined, and I'm once again left wondering to what degree he is joking. It is around this time that the American election news cycle is starting to popularize the narrative of 'post-truth' politics, with accusations made of which party hacked whom, and whether the leaks were altered or not, providing polemic fodder for accusations of untrustworthiness.

It seems to me, however, that this corner of America has long basked in so-called post-truths. As we pass through the desolate landscape, Jeff plays the tour guide by pointing out an extensive 'what's what' of local legends and myths: former bandit hideouts, the site of the infamous bigfoot picture, the China Lake US Navy weapons research base, and Edwards Air Force Base, home to Skunk Works/Lockheed's secret projects. As we approach the western edge of Death Valley I think to myself, if our meat-sacks weren't so feeble we could even walk to Area 51 or the Nevada nuclear test site just on the other side. Each place has its secrets, allowing myths to be made and remade in their scaffolding.

Of course, when I say Jeff points these places out, it would probably be more accurate to say that he gestures broadly to somewhere beyond the sand dunes from time to time. This ostensibly empty area is full of things that Californians and their neighbours are well aware exist, yet have no direct access to, a mindset that has probably congealed since the Gold Rush era. Central California is a good place to hide, to be hidden. When talking with the locals, I notice that the character of these 'known unknown' sentiments leak into other areas, such as elaborate conspiracy theories about the government manufacturing current drought conditions (five years and counting), or concerns about the government's poisonous chemtrails streaking the otherwise perfectly clear blue sky. And though incomplete information can lead to a 'paranoid style' of thought (Marcus 1999), grinders do not make conspiratorial leaps of imagination to fill in the gaps. Instead, they take this uncertainty as a jumping off point for excursions into the boundaries

of human possibility. Paranoia about the future may help for writing dystopian novels, but it would be counterproductive for pre-empting cyborg bodies.

What grinders and conspiracy theorists do share, however, is the sentiment that a lack of access to knowledge, or the prevention of knowing about something that *you know exists* is frustrating. And while west coast grinders have been living in this environment for years, the conditions for these frustrations extend into grinders' perceptions of the very quality of knowledge they have access to. As this chapter will demonstrate, this sentiment is in part attributed how medical, educational, and private sectors *limit* their access to knowledge and experience, which pushes grinders to pursue body enhancement through a do-it-yourself (DIY) approach outside of established avenues. At the same time, the DIY approach confronts them with an *excess* of information that must be navigated. Between these limits and excesses, grinders carve out a political space they hope will effect their preferred future.

If not us, then who?

To understand the implications of grinders taking the DIY route, I asked them about other fields that might be interested in 'fixing' the weaknesses of bodies. Their answers revealed critical and often outright distrustful views of the medical field, the scientific research field, as well as private industry. It is in these critiques that we find both hints about the types of bodies grinders hope to instantiate, as well as how the failures of these institutions contribute to grinders' modes of production.

1. Frustrations with the medical field

The normative medicalized view of the body is rejected by grinders, who take exception to the body being defined by the parameters which institutionalized medicine has set in place. While grinders might agree with the general medicalized position that bodies are valued based on their capacity to perform and represent (Frank 1990), their perspectives diverge on where these valuations should end. Grinders repeatedly bemoaned how the medical field is designed to get people back to 'normal,' and no further. 'Do no harm' to a doctor means, with all the certitude of the Hippocratic oath, no experimenting on people. But for a grinder, maintaining normal *is* doing harm because it does not address the increasing disparity between bodies and their socio-material environment by setting unreasonable limits. It is not a question of doing 'no' harm, it is

a question of which harms would be better avoided. For grinders, the medical industry is too reactive in a time that demands proactivity.

Inevitably, being proactive about health and trying to save humanity from its own biological limitations necessarily raises the spectre of eugenics (Hughes 2012; Newman 2010; Tirosh-Samuelson 2012). Francis Fukuyama (2002) argues that modifying bodies through technology threatens humans and human nature. Leaving aside Fukuyama's weak appeal to an indefinable 'human nature,' this argument is at least partly based on valid concerns about unequal access to resources (Mehlman 2012). Fukuyama (2004) asks, "if we start transforming ourselves into something superior, what rights will these enhanced creatures claim, and what rights will they possess when compared to those left behind?" (p. 42). Likewise, Jotterand (2010) claims that technological bodies would undermine the "uniqueness" of each human body, and therefore deprive it of dignity. While Fukuyama and Jotterand argue for maintaining the stability of the human category with all its supposed flaws, Bostrom (2005) counters that such stability is illusive, as even human genes are in constant flux. If enhancing the body is fraught with such cultural and social tensions concerning how to evaluate whether a given enhancement will transcend or transgress the human category (Culbertson 2011; McNamee 2007), then grinders' critiques of the medical field provide insight into how their bodies have become an arena for contentions surrounding institutional processes of normalization.

The central contention is unsurprisingly about economic influences. The medical industry is perceived by many grinders as corrupted by money. For example, Ben's job at his university puts him in contact with medical PhDs candidates who "seem shady." When I asked him to elaborate, he added, "their stuff is always like, 'how can we make this thing more efficient to make more money' […] because most doctors want to open their own practice, and they have to know how to run a business. But it also kind of forces them into the [idea] medicine is a business." And once it is more about business, he supposes, it can lose the 'medical' point and becomes a practice of risk aversion, litigation avoidance, and, of course, profit maximization.

Not only might medical professionals be swayed by risk avoidance, grinders are concerned they may be corrupted by the tension between institutional goals and cultural norms. This argument, at least as old as Merton (1938), argues that the practise of science is debased by the pursuit of money, publishing requirements, or other non-scientific reward. Grinders, like the

DIY biology community, are constantly confronted by difficulties with how scientific knowledge is created and distributed (see Delfanti 2013). For example, Rich habitually reads medical journals to find ideas for his next grind. Though occasionally fruitful, he also notes that "[..] one thing I found there is a lot of those things that are in clinical human trials are complete and utter bullshit. It's something that will not work ever, but somebody got a ton of money." Likewise, Max figures that in order to pay their school student loans, it is easy enough for medical researchers to justify faking data to get sufficient funding to cover the costs of US Food and Drug Administration (FDA) regulatory processes and lawyers for patents.

Not only are grinders skeptical of medical research data, there is also skepticism about the low threshold for requiring medical 'expertise' at all. This normalizes common practice to go to a doctor for simple maladies one could easily solve on their own with a little self-education, something Gabriel learned firsthand.

> I was on a vacation with a girlfriend at the time, and she had a little bit of a medical emergency and we ended up taking her to the hospital. So the problem was we were really inebriated the night before and she was developing a fever. She had basically a blocked gland and there's no way -- it was like two o'clock in the morning -- there's no way that we're going to the hospital because we were both crazy drunk. But I was like, this needs to be taken care of now. And so I made a scalpel out of a safety razor and a chopstick and some electrical tape, and drained -- and sterilized it and then drained it. And so we get into the hospital the next day and the doctor who's examining her is like, 'ah, this is -- looks like you actually took some steps here.' Like, yeah. [The doctor] goes, 'Are you pre-med?' I'm like, '... sure. Sure, why not?' (Gabriel)

The doctor was impressed enough with his work that she let him help with the rest of the minor surgery procedure. His takeaway? "[S]o you do a couple of those things and you start coming away from these situations being like, well, a lot of this is bogus. And so when the question was put to me if I wanted to continue doing formal education I was like, ah, no, I'm okay." As Gabriel explained, it isn't that formal, institutional education is useless but rather that it is economically dependent on securing a monopoly over how to gain legitimate experience. The information necessary to 'practice medicine' is freely available on the internet, and the

opportunities for experience can – or at least should – exist outside of institutionally-defined boundaries.

Moreover, during my fieldwork grinders continually expressed anxieties about their practises becoming restricted by government regulations. I always thought they were being overly paranoid, since in my estimation grinders operated in low enough numbers to fly 'below the radar.' In particular, they were worried about the FDA preventing self-experimentation, even holding meetings to discuss how to prevent such an outcome. As it turns out, my prognostication was at least partially wrong. Previously, gene-therapy existed in an ambiguous state, but in late 2017 the FDA declared it would now require the "submission of an investigational new drug application," thus giving it regulatory authority ('Information about self-administration of gene therapy' 2017). Performing or even selling products that facilitate DIY gene therapy (such as CRISPR/Cas9) were now illegal without FDA approval. Gene therapy is only a small part of what grinders are interested in, though it has become more popular over the course of my research.

There is thus a double detriment to body augmentation as a result of the social and economic pressures felt by medical authorities. Not only will medical professionals not go beyond established medical norms, the field itself increasingly encroaches on the agency of non-professionals by having some of the 'simpler' authoritative medical knowledge disseminated exclusively through authoritative medical avenues. For example, Frank points out that even barbers used to be allowed to set bones and pull teeth. Other grinders noted how it is now illegal in California for a layperson to apply sutures, effectively giving medical professionals authority over the boundary of the inside of your body. The medical field thus censors bodies by withholding both information and access to 'legitimate' experience. What does the inside of a finger look like? We are not allowed to know, except by accident, in which case it should be closed up as soon as possible at the nearest clinic (and don't forget your insurance!).

Fortunately for grinders, this authority is not absolute. In an exercise to retrieve expert knowledge, Grindfest Two featured a suturing workshop to practice stitching up 'injured' orange peels. It was one small step in emancipating corporeal insides from the tyranny of authority. Over in Utah, Ben believes his lack of authority actually gives him greater freedoms. According to his understanding of state law, piercing shops cannot possess scalpels, and since he is not a

piercing shop ("just some guy stabbing his friend," as he jokingly puts it), so long as there are no complaints he will be free to experiment.

Nonetheless, Ben further mentioned his preference would be to have proper access to medical treatment from experts for safety reasons, but for now they are outweighed by the aforementioned concerns. Many grinders try to avoid interactions with medical professionals for fear of negative repercussions. Historically, popular and psychological discourses of mental illness and upholding the 'natural order' have been unkind to the body modification scene (Krazniewicz 1992; Lemma 2010; Pitts 2003), a fate grinders do not wish to share.

Less of a critique of Fukuyama and Jotterand, then, grinding is perhaps better understood as a reaction against what Wailoo (2007) calls the "new eugenics" (p. 662), where bodies and identities are increasingly fixed by medical services and 'counselling.' New eugenics are not coercing to "eradicate the 'unfit'" (Wailoo 2007, p. 662), yet they still reproduce hegemonic norms informed by dominant legal and bioscientific discourses of health (Evans 2003, Hamilton 2009; Kember 2003; Schmidt & Moore 1998). Grinding is not eradicating the unfit, but instead attempting to eradicate what it means to be fit as defined and enforced by medical discourses. In practise, however, as will become clear later in my argument, this becomes complicated.

2. Frustrations with the university scientific research field

Even though many grinders have completed or are pursuing degrees at universities, the formal scientific research system is also often perceived as a hindrance to grinding. Though it is recognized as generating authoritative knowledge, attempting to navigate its rigid structure is frequently decried as a waste of time. This attitude is partially a result of the anti-authoritarian mindset that some grinders tend to exhibit. For example, Marlo enrolled in bachelor of science programs five times, four of which he quit within a month, and another time was kicked out for starting a fistfight with a professor. The roots of grinders' difficulties with the university research system, however, are more complicated than problems with authority figures.

To begin, the scientific field also exhibits many of the same perceived structural issues as the medical field. Once again, grinders' mistrust of authority protectionism stems from a skepticism about science as a business. With respect to the scientific field, they expressed concerns about the scientific method's tenet of repeatability having been suffocated by patents, ethical review boards, and the pressure to publish. Journal articles (and the system of journals

itself) only demonstrate *that* science is being performed, but *how* the results are obscured just enough that they cannot be verified. They are written as if attempts at replication are not possible or even expected (see Collins 1985). Many of the more productive grinders scour scientific source materials despite acknowledging the knowledge gained from the literature may be unreliable or misleading. This frustration sent Justin into a rant:

> The amount of nanotech papers that I've read that have no pictures of the fucking nanoparticles and they've only got graphs -- if you only have a graph in a nanotech paper I want to find you and punch you square in the face because I can't tell if my thing worked because I don't know what colour it is and I don't know what it's supposed to look like. Is it opaque? Is it clear? Is it -- you know, what's it look like under the microscope? I don't know because they don't post it.

There is no excuse for this, Justin elaborated, since someone with access to a cell phone camera could take pictures of their procedure rather than obscuring the method through a dry write-up. As his rant continued he seemed to get increasingly carried away (he later told me he would have studied theatre had he not pursued science), though his half-joking reference to punching scientists who obscure information suggests their actions are, to him, significantly damaging. The only way for him to reproduce the article's results was to "do the same fucking things that they did" by trial and error, mistakes and all. Moreover, since journals tend to only publish positive results, there is a nebulous pit of scientific work somewhere that one can only assume has never been attempted, further wasting time and impeding progress. Justin paused for a second to catch his breath. "The systems are fucked. […] Everyone go fuck themselves."

While researching the potentially beneficial effects of vasoactive intestinal polypeptides (VIP) on humans, Jeff and I ran into similar problems. Though there was extensive literature available (through my university access, of course), the administration methods were unclear at best. In an attempt to gather more information, Jeff looked into the publishing history of one particular author to see if her other articles might elucidate a clearer methodology. When viewed chronologically, he noted that her publications started off as "pretty legit" and "hard core" research but then gradually shifted towards drug manufacturing. Jeff wondered out loud if she

was just following the money, or (he added jokingly) is she going criminal? It was a question left to the conspiracy theorists, while we continued on as best we could.

In light of these sorts of issues, Max has almost given up on scientific literature in the bio field. Germline gene therapy, he tells me, is a promising (and controversial) procedure of editing genes for desired traits that will be passed through generations. Unfortunately, it is difficult to tell which germline research is fraudulent, and you may end up wasting years basing your own research on faked results. "The amount of fucking retractions and stuff that turns out to be bullshit out there, if you figure that most people are smart enough not to just cut and paste the same picture of a cell repeatedly, or obviously doctor images from the same image and cut little bands out of the gel, there's probably a lot more of it out there." He hears from his coworkers that it is not uncommon for a principal investigator to tell PhDs to "fudge those numbers, [or] just run it again until it works." With decreasing funding for anything that is not cancer research, it's necessary to 'tweak the conditions' to exaggerate the significance of results if you want to keep doing bio research. Ultimately, Max tells me, "…there's really very little basic research getting on."

Difficulties with trusting research reach down to the university system itself. Few were as outspoken about their experiences with university and science culture than Gabriel and Justin. Gabriel spent time in graduate school, but became frustrated that having access to the proper equipment meant working on somebody else's ideas. Both remarked that if you want to pursue your own projects you need your own lab, which means going through the overly-extended academic process of attaining tenure. Justin, who at one point was enrolled in an undergraduate biology program, seemed particularly annoyed by some of his classmates who merely wanted to pass courses without learning or doing anything innovative, thus creating an environment that fosters jumping through hoops and not ground-breaking research. Refusing to participate in a culture of simply going through the motions, Justin dropped out, concluding that a degree is "a stupid piece of paper that says I can regurgitate information on a stupid fucking test […] Right? Like, fuck that. That's not a test of ability. That's a test of stupidity, and patience, which -- I don't have patience for stupid. So eventually it hit a point where I was like, no, I'm done. Fuck it. I'm doing my own thing."

And why not? When it comes down to it, according to Gabriel the main function of universities is dated:

> And really, I mean, the whole university system is like this 500-, 600-year-old system. Hasn't really changed a lot. […] One of the purposes of having a university is so that you got a location where they stored knowledge and everybody could go and access that knowledge. And we have something like that and it's called the internet and it works way better than a school library. And so on top of that people will say that, 'Oh, but you can't really trust the internet.' And it's like, I don't know, Wikipedia's actually fairly good. And you're just as likely to get bogus information from somebody who decided that they were going to write something because they needed to write a chapter for a textbook as you are from the internet, except when you do it through school that's your only option. Like you have to believe it. (Gabriel)

In light of grinders' experiences with faked or useless data, it makes some sense to consider Wikipedia and the university system equivocal. Even if one of the two produces a greater percentage of legitimate research, not knowing which parts of the research are legitimate means it all must be treated with skepticism. Instead of being able to build off of reliable research, grinders find themselves having to test the premises either way.

Finally, although not explicitly raised by grinders, their criticisms taken together reveal another problem with relying on the formal scientific field for corporeal enhancement. It is not only that scientific knowledge production is restricted, incomplete, or even wrong – it is also limited by its application. As Goldman and Turner (2011) explain, the very production of scientific knowledge is guided by management goals informed by ideas about society and environment. Even though grinders can and do participate in university research, there is no space given to grinding itself as a practice. In short, if there is no official scientific field dedicated to experimenting with human enhancement beyond norms and economically viable products, then there is an intellectual lacuna that can only be filled from the outside.

3. *Frustration with private industry*

What of the free market? One would think that augmenting bodies is a solid business plan, given the massive potential target population. As I discovered throughout my fieldwork, however, human enhancement is such a good idea that the market is flooded with promises of

products instead of anything proven to be tangible. These 'product-ideas' (since the product merely represents an idea that it cannot deliver) are commonly referred to by grinders as *woo*. Generally speaking, woo is a persuasion to seek favour, as in, 'wooing a romantic interest into a relationship.' For a grinder, however, woo is snake oil. It is unsubstantiated persuasion. It is an unfulfillable promise of a better future. It is irrational belief dressed up in flashy marketing. Grinders despise woo, and they apply the term freely in efforts to differentiate themselves as scientists from ware-hawkers and pseudo-scientists lacking empirical evidence.

In light of the problems previously identified with fraudulent scientific and medical research, it is sometimes difficult for grinders to maintain this distinction. During the course of this research, I, too, found myself occasionally confused by ambiguous claims. This was most apparent on the vendor hall of the 2016 Bodyhackingcon, where grinders demonstrated their latest projects in booths positioned near others promoting the detoxifying effects of Qi energies, anti-aging skin products, and a vast array of supplements that promised increased powers of memory and focus. One in particular caught my eye because I had already heard different grinders praise it as effective and deride it as a scam: Bulletproof Coffee. Promoted by self-proclaimed 'biohacker' Dave Asprey, their main product involves adding butter and 'brain octane' oil to their unique coffee beans, which they claim will boost brain function and clarity. Asprey's website cites scientific articles in support, and a cursory Google search turns up multiple pages citing scientific articles to debunk it. Whether or not it is a scam, it is easy to see how grinders may find it difficult to separate themselves from other scandalized (rightly or not) promotors of enhancement. Grinders will sometimes refer to these promotors as the "vitamin cult," a derogatory term for those who conflate something with empirically proven scientific value (e.g. vitamins) with exaggerated, pseudo-scientific claims about weight loss, mental superpowers, or chakra alignment. Biohack.me moderators are always on the lookout for postings of such woo, which are usually conspiratorial or supernatural claims by new posters about mushroom-powered computer brains or psychic government mind-control[5].

Woo-mongers aside for a moment, when looking for an organization to effect positive change for the augmentation of humans, one might look to a transhumanist group like Humanity Plus (also known as H+). H+ is one of the world's largest transhumanist groups, boasting an

[5] Many of these threads are deleted, others are shut down (e.g. 'Reverse Aging' 2017) and some ideas are briefly entertained just to make sure (e.g. 'The notorious mushroom thread' 2013)

international roster of well-known scholars and scientists including Nick Bostrom, Max More, George Dvorsky, and Aubrey de Grey. They claim to be an "international nonprofit membership organization that advocates the ethical use of technology to expand human capacities. In other words, we want people to be better than well" ('About Humanity+' ND). So why does grinding emerge on its own rather than latching on to a well-established movement with similar goals? As Justin sums it up, "Do I want anything to do with the transhumanist crowd? Fuck no. Oh, my god, is it full of woo."

Even though many grinders are sympathetic to or outright identify as transhumanists, the west coast grinder scene[6] is suspicious of transhumanist organizations like H+ being self-serving parades of fundraisers supported by silicon valley cults hooked on promises of cryonics and longevity. After sneaking into one of their fundraisers by borrowing a doctor's badge, Max concluded it is more or less a scam: "If you want to make some money out there and you have no moral scruples you can do it, man. Just be like, oh, we got a new wave generator that subconsciously shifts the paradigm in your neuro-cortex and then delivers high energy theta -- you know, you just go on and on and fucking whatever. Give someone a placebo and make a few mil before they get wise, if they even do, and then you're set."

Above all, the most common criticism of transhumanist organizations is there is no action, just "all talk and fundraising to sustain their bullshit infrastructure and cult" (Rich). The H+ website banner proclaims "Don't limit your challenges, challenge your limits," yet aside from waiting around for computers to get better, or for artificial intelligence to somehow solve their problems (waiting for the "AI genie" as Rich puts it), it appears little to nothing is being done to actually implement tangible ideas. "[T]he whole thing with transhumanists is they're all about waiting to get their jetpacks and flying cars. It's never going to happen for them" (Rich).

If well-established transhumanist organizations are not trusted to augment bodies, then what about other corporate possibilities from private enterprise? Just because people are making money off of the *idea* of augmentation does not mean there is no money to be made with a legitimate endeavour. By this point it is probably unsurprising to learn that grinders are also wary of products put out by corporations. There are, of course, the same concerns about 'profits

[6] In other parts of the country (notably Minnesota), there appears to be no dispute between grinders and transhumanist organizations. Many interviewees on the east coast were largely unaware of any 'rift' between grinding and other transhumanist organizations.

over people,' but in private business it goes beyond the fudging of data for profit that exists in the medical or scientific fields.

To rely on a corporation would be to reinforce the very power imbalances that disadvantaged their bodies in the first place, with a disregard for the environment and a reliance on experts' self-interested protection of proprietary knowledge. Grinders cannot accept a company telling them "You can have this and it will do exactly what we tell you, but if you want to use it, or you want to change it, you can't because it's ours" (Matt). Trybal Wolf foresees getting trapped in a proprietary system of planned obsolescence with body implants, where you have to cut yourself open after six months to replace implant version '1' with '1S.' What if the company stops supporting older models? When putting something in your body that will become a part of you, it cannot be "here's your device – buy it, asshole!" (Evan). It needs to be hackable. It needs to be open source so that the user knows what it does and can alter it to their personal preferences.

> If something's becoming part of you, you should understand it, and even if you don't understand it, you should have the -- if not the ability to alter and modify it, you should have the right to get in there and change it and modify it. You should own it if it's part of your body. (Marlo)

In my estimation, here Marlo has summed up the paramount reason grinders' opt for the DIY approach, why they volunteer to test implants for each other, and why they work together to share information on biohack.me. If bodies are to become integrated with emerging technologies, then being able to control those technologies is key to maintaining control of the body and therefore the self.

But even beyond rejecting corporate models of production, there are doubts a corporation could successfully build and market a non-medical implant in the first place. They might have more resources, notes Grindhouse CEO Justin Worst, but they also have a lot more liability. Google cannot get through human trials faster than a grinder, since grinders have little use for feasibility studies or market testing. Indeed, it has always surprised me how many and how fast people on biohack.me sign up to be guinea pigs for in vitro testing. It seems only the collaborative grassroots nature of grinding can bypass ethics boards and legal impediments to

produce innovative augmentation modifications. In fact, that is a large part of the appeal for many grinders like Tim and Brian (though, to be fair, Brian also admitted he would let Google implant a Bluetooth device in his head, *with ads*, if it enhanced aural capabilities. He balances this allowance by claiming he's become quite adept at tuning out ads in the first place). Because corporations are bound by rules of economics, ethics boards, and regulation oversight committees, they are not in a position to pursue enhancing bodies like grinders are. If (and when) they try, it is likely to result in woo since it is easier to defend or deflect a pseudo-scientific claim than it is to accept liability for actually harm caused to bodies.

The underdetermined bodies of medicine, science, and private industry

The medical field, the institutional scientific research field, and private industry are therefore unreliable places for grinders to find their augmented body. They are certainly entities grinders borrow from (see chapter 4), but their structures make them too focused on money to be considered trustworthy, and their institutional rules and regulations preclude them from human experimentation. They function in a way to keep 'human' at a particular level by making it natural and necessary. Yet, as I will demonstrate in the following chapters, grinders nonetheless have to contend with the normalizing discursive practices that emerge from these areas concerning what they are or are not allowed to do with their bodies. For now, we can at least see how grinders feel immediately disadvantaged by limited access to expert knowledge, whether through withheld medical expertise, potentially falsified scientific information, outright scams, and/or corporate proprietary protectionism.

That said, the DIY approach also relies in many ways on these institutions. Though institutional avenues do not lend themselves to directly advancing the grinders' causes, it is worth briefly noting their less direct contributions. First, when the medical, educational, and private sectors define the normative limits of the body, they also help lay the intellectual and material foundation for ideas of enhancement. They are, after all, the sources of most known knowns. Moreover, even if these institutions are critiqued for not going further, grinders still need occasional medical attention, and many have attended, are attending, or will enrol in university programs. Popular transhumanism, though perceived as unproductive, has guided people towards the grinder scene, boosting its numbers and overall talent pool.

Second, institutions also produce a lot of the physical goods that make grinding possible. Since Marlo began working more closely with Grindhouse a couple of years ago, he's noted the size of consumer-ready computer chips has halved while the amount of features has drastically improved, and that we are now at a point where computing technology is approaching levels of availability and affordability previously unseen. Moreover, instead of building circuits and devices from scratch, some cost-minded grinders have repurposed Chinese knock-offs (though this is taking a chance on quality). The average person may not be able to procure the latest tech, but with some searching decently advanced tech can be found for a reasonable price. The grinder scene is still relatively small, possibly because this price/technology threshold has only recently started to be breached. Economically, no grinders are what I would consider to be wealthy, but neither were any of them struggling to keep themselves fed. Technologically, at this point having something the size of a deck of cards implanted in your arm (such as the original Circadia from Grindhouse Wetware) isn't worth it, even for most grinders. However, it is easy to imagine when cameras are "the size of a flea" or batteries "the width of a dime" (Jacob) that more people will be willing to get involved, especially once Chinese knock-offs are available for exploitation.

Grinding as a movement is therefore a result of both the limits and fruits of institutions, and the specific processes of these relationships will be elaborated on in the next chapter. Because medical, university, and private research are hindered by socio-economic interests, as far as grinders are concerned, their outputs are marked by underdetermination. In other words, the potential of the body is being dangled just out of their reach. The medical sector withholds information and experience, the scientific sector produces unreliable and/or incomplete information, and the private sector is fraught with information that is proprietary or, even worse, woo. The material, intellectual, and ideological resources necessary for grinding thus necessitates a non-institutional approach. However, as the balance of this chapter discusses, attempting to disrupt these institutions' constraints on knowledge through a DIY approach reveals the opposite problem: that an excess of information is just as likely to undermine body augmentation.

The taste of one hand clapping

There is, I suggest, another interpretation of woo that will be helpful for understanding how grinders test ontological ambiguity. The Chinese meaning of *Wu* (or *Mu*, in Japanese) is revealed through its application in Zen Koans. For example, a monk asks "Has a dog Buddha-nature or not?" The Zen master replies, "*Wu*" (Yamada 2004). The precise English translation of wu is (appropriately) difficult to pinpoint, though its meaning is generally understood as "absolute nothingness," or "the relativity of affirmation and negation" (Heine 2011, p. 177). I think a computer programmer might translate it as 'void.' More importantly, wu is an attempt to "reveal a bias in undermining the truth claims of the tradition" (Heine 2011, p. 177). It is, according to Hooper (2003), to reject metaphysical speculation (i.e. woo), but not a rejection of the metaphysical itself. This is a distinction that grinders confront constantly, as such an answer is "not to be reverenced as dogma but is to be *tested in life*" (Hooper 2003, p. 291, emphasis added).

Within grinding, *woo* is dismissible, while *wu* is a state of indeterminacy, an invitation to possibility, an unknown unknown. Aurally, one need not make the distinction, and in practice grinders determine woo or wu on a case-by-case basis, sometimes even disagreeing on which designation applies. For example, though he never explicitly uses these terms, Jeff once acknowledged that it is difficult to distinguish truth claims when evaluating conspiracy theories; most would dismiss them, but they have a quality that makes it hard to know for certain. While woo is useless or even harmful (e.g. a healing crystal scam), wu can be useful to grinders when trying to make the sensible out of the senseless because it is neither true nor untrue. It becomes especially relevant when a sensory experiment does not outright fail, but you also cannot tell whether it definitely *worked*, either. Newly created senses always begin as wu, since there is little experiential or linguistic frame of reference to compare it to. When I walked the convention floor of Bodyhackingcon, it was mostly wu to me, even if certain booths were clearly woo to others.

Wu is a helpful concept when attempting to enhance new senses, and it also arises when 'traditional' senses are modified or become entangled in new ways. In this chapter I have already provided examples of knowledge concealed by modern structures of expertise and how this disadvantage motivates grinders to DIY, but such an approach confronts other forms of concealment arising from a related emerging sensory entanglements. Unlike the institutional structures that conceal by withholding knowledge, these sensory entanglements conceal through

an excess of indeterminate knowledge that must be *tested in life* to become actualized. Though this issue arises repeatedly for grinders from multiple sensory directions, emerging entanglements of *visualities* in particular reinforce the need for grinders to take a DIY approach.

That the quality of visuality is changing is not lost on grinders, whether it be written texts or electronically mediated images. As a general rule, grinders are tech savvy, and you would be hard-pressed to find one who believes any given advertisement has not been photoshopped to hyper-real levels. What difference does it make if it is faked, if its fakeness has a pleasant effect, or no effect at all? As a counterpoint, during the recent rise of the Black Lives Matter (BLM) movement a string of police shootings of minorities captured on tape seemed to be ineffective in producing justice. What does it matter that the video is real, if its realness has no effect? In both cases, the visual-truth is for some reason underwhelming, even if examples of both are occurring at an increasing rate. This result can be explained by what Kroker (2014) calls 'remix culture,' where the acceleration of information directs the human mind "beyond its immediate circumstances and into the global circulatory flows of distributive consciousness," where boundaries of referents shift, and where concepts of "gender, class, race, nationalism, knowledge, even sexuality" are undermined (pp. 13, 94-96). To cope with being bombarded with information at such speed, questions of truth are necessarily put aside in favour of determining "immediate 'effectiveness'" (Virilio 2005, p. 2). Because of the speed of remix culture, visuality has to recreate itself in order to stand out even when every recreation adds to its mass which is continually self-collapsing.

The effect of the diminishing visual veracity within remix culture is best illustrated, I suggest, in the use of 'click-bait' advertising. If no one believes what they see is the truth, then the next best thing is to play up the ambiguity (the *wu*) of what the truth *could* be behind the headlines. Thus, things that appear fake can become true enough, and things that appear real can quickly become false. In addition, the more pervasive click-bait advertising becomes, the less effective it is, requiring new strategies to entice consumers to click and find out whether it was woo or wu. Again, it must be *tested in life*. Though this analogy is my own, it is comparable to how the medical field, scientific research field, and private industry produce products that function similarly to click-bait, where their claims must be tested in life by grinders or someone they trust, hence the do-it-yourself approach.

Grinders hate woo, but I noticed they seek out and thrive on wu. One example of visualities entangled by remix culture comes from Grindfest Two, when the topic of conversation turned to which parody bots they found most entertaining. For the uninformed, a bot is essentially a computer script that can seek out and modify information using predetermined parameters. A Twitter bot, for example, will scan tweets and then repost a modified tweet, or mash up multiple Twitter accounts to recontextualize its essence. Consider the @StealthMountain Twitterbot, which will scan for tweets containing the words "sneak peak" and automatically reply "I think you mean sneak peek." Another account, Robot J. McCarthy (@RedScareBot) Twitterbot, which will search for any mention of communism and reply with accusations of socialist threats. These bots create sensory hybrids, in this case taking two visual types of information to produce a new one.

Taking turns, the Grindfest attendees shared their favourite bot stories, such as the Random Darknet Shopper, a bot programmed to make random purchases that ended up getting 'arrested' after purchasing MDMA (see Schroeder 2015). Another account the grinders found especially amusing was Erowid Sarah Palin (@SarowidPalinUSA), a Twitter bot that mashes up Sarah Palin speeches with Erowid drug trip reports. On one side, Palin's speeches are folksy, awkward, and occasionally incoherent. On the other side, Erowid is a repository of often colourful 'trip reports' posted by users of various illicit mind-altering substances. A brief sample: "The cactus knew I wasn't ready to make America great again" (April 16, 2016); "Donald Trump has awakened the electorate and exposed the self-serving self-transforming machine elves" (April 15, 2016). The delight grinders take in Twitterbots exemplifies their lack of cultural anxiety about ontological instability made possible when the "objective appearance of technological media of communication" replaces hierarchical knowledge with "the diffuse, the fragmentary, the connected" (Kroker 2014, p. 5). There is no object permanence in remix culture, given the 'posted date' might even be modified (yet paradoxically, at the same time anything put on the internet is assumed to be 'out there' in the public realm forever).

As if to underline the absurdity of trying to find the boundaries of remix culture, Rich recounted a rumour that Erowid itself had been 'infected' with a bot that constructs new trip reports out of the trip reports of other drugs, effectively corrupting its intended purpose. In other words, the real account of a drug-altered reality is itself altered through a real bot, creating an alternate altered reality. This strikes me as the perfect example of the glamorization of excessive

hybridity, a celebration of wu (just because it needs to be tested in real life does not mean it will be or can be), where there is little use in trying to trace back any of the original meanings. Part of the appeal of bots is the way they remix discrete chunks of information to create something interesting. They are indicative of "the ontological foundation of the posthuman axiomatic" (Kroker 2014, p. 16), where small fluctuations in what information *means* reshapes what is considered knowledge.

However, Grindfest Two was not the last I heard of Erowid. Several months later, on the opposite coast, a couple of grinders were espousing its virtues to me. They viewed it as a triumph of citizen science, in that it was capable of collecting data about the effects of various illegal drugs where official channels could not. It was a perfect example of bypassing the medical, scientific, and private entities that underdetermine grinders' bodies, and it therefore symbolized the potential success of a DIY operation like grinding. I asked them if they had heard of the rumour Rich had mentioned to me earlier about its corruption by a bot. The one grinder slumped in his chair. "That would suck. I mean, that does suck but that's a problem with so many things." Remix culture, it seems, must still be tested to determine how the information works.

To be fair, I do not actually know whether Erowid is full of fake posts. Nor do I know if Robot S. McCarthy is really a bot, or a person pretending to be a bot. Did the person who created the bot order those drugs, or did the bot do it independently? Does it matter? Sometimes it will, but it is a certain category of knowledge that is neither true nor false; it is both, it is *overdetermined* – it is wu (and quite possibly woo).

And as much as grinders share a disdain of vitamin cults and harmful conspiracy theorists, there is something in common between them that leads to sharing a convention centre floor at BodyHackingCon: they both purport to find ways of sensing the previously insensible. The difference is, while the crystal-chakra crowd exploits woo for profit, grinders ingest wu to separate the physical from the metaphysical. To achieve this, as they showed me time and again, it is necessary to wade through the various truth claims and the materials that support them, commit trials-and-errors ad nauseam, and, most importantly, you have to do-it-yourself.

Grand theft future

To summarize up to this point, grinders perceive bodies as frail (yet resilient) and this frailness is exasperated by social and political circumstances. Remaining idle seems a bigger risk than self-augmentation through experimentation, and so something has to be done. Medical and scientific fields as well as private industry are structured in a way that reduces access to legitimate knowledge for grinders. Their paths to the grinder body are underdetermined. Compounding this difficulty, grinders have to wade through an excess of overdetermined hybrid and/or contradictory information to find out what will work. As much as grinding is a reaction against these conditions, grinders must also find ways to make these conditions work for them. As a result, grinders' informational climate forms the conditions for a particular type of productivity that must be tested in life.

The formation of a grinder mode of productivity is exemplified at its extreme by Rich Lee. Rich describes his pre-grinder life as "super hardcore into industry and capitalism and Ayn Rand kind of crap." But after years as a businessman in the USA and China, he lost faith in the virtues of free market upon realizing "the system is stacked against people." His response was to reinvent himself as a self-described space gangster, set on exploiting and disrupting capitalist knowledge circulations. He calls this scheme *grand theft future*, because it takes back the body's potential from the so-called professionals' sacred knowledges, from the gatekeepers that have stolen the common person's agential freedom.

To commit grand theft future, Rich teaches me, is to find the technologies that trump ideology[7] and make them freely available to everyone. He gives me a few examples: the problem with world hunger is not the distribution of resources, but rather that humans get most of their energy from ingesting food. Arguments about buying, distributing, or growing food are merely displacing the problem, not solving it. Being able to take advantage of solar power, for example, might be an actual solution. Likewise, assault is a serious problem, but it would be

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[7] This idea comes from a William Gibson quote, which Rich read to me from a saved file on his phone:

> Technology invariably trumps ideology, and I am inclined to think that history increasingly suggests that human social change is more directly driven by technology than by ideology. I think we develop ideologies in an attempt to cope with technologies, and in fact, we've been doing that all along. Technology is knowing how to grow, harvest, and store cereals without which you can't really do a city. Technology is knowing how to build efficient sewage infrastructure without which you can't build a slightly larger city. So I think of technologies as the drivers and ideologies as an attempt to steer.

much less so we could regrow or replace limbs. Racism would cease to make sense if the colour of skin is changeable. These ideas are overlooked, he suggests, because their premise is so simple (I note the latter example is the plot of Dr. Seuss's *The Sneetches*) and because society is heavily invested in existing socio-political arrangements.

Given the aforementioned economic biases of the medical, scientific, and private sectors, Rich finds it likely that even if these institutions were to pursue these radical solutions they would be held up in patents, legal disputes, ethics committees, and kept out of the hands of the people who truly need it. Instead of approaching social problems through the question of how to include marginalized bodies (as Butler 1993 might), he aims to demolish what makes exclusion possible. I see in Rich's strategy an eschewing of *re*thinking of boundaries, and instead trying to *un*think boundaries.

> I feel if there was something so important, that it'd be my duty to go and rip it off and reverse engineer it and I [will] come out with plans to build it yourself, you know, just throw it on the internet. […] There's going to come a point where somebody's going to try to pull that patent bullshit and it's going to be something super important that's going to give one class of people a huge advantage over another. […]
> To me that's about distribution of information, but it's also about disruption, I guess, because it's good examples of the knowledge getting out, right? You know, people empowering themselves, using the technology to empower themselves and not have to go through gatekeepers. (Rich)

In support of his argument Rich cites several historical examples, such as the polio vaccine disrupting religious authority over illness, digital file sharing disrupting record companies' hold on the music industry, and 3D printing disrupting most things related to the 'Walmart economy,' from screwdrivers to long-distance shipping. To be sure, these events have caused *re*thinking of boundaries – the digital download market for music and the narrative push about 'piracy,' for example, which cling to traditional boundaries of property – but in a world where music is digital there is no longer a compulsion to think about music in terms of ownership.

Once an industry is disrupted and into the hands of the people, Rich predicts true innovation can happen. Grand theft future has already taken different forms outside of the

United States, with a prime example being the Chinese black market. Rich buys knock-off 'brand-name' products from China not just because of the cheaper price, but also because they add extra features like hidden change pockets in suit jackets, or umbrella holders in purses. He gives me another example of DIY engineers creating their own 3D-printed guns. He sees these alterations as not just adding utility, but also facilitating new forms of expression. "And once something is disrupted," he adds, "it's over. Genie's out of the bottle, and that's it." It can no longer be contained, rendering regulatory mechanisms powerless. There is no point arguing about whether 3D-printed guns are 'good' if there is no way to stop it.

For Rich, these kinds of changes are inevitable, and it is this inevitability that demands response. Rich is attempting to disrupt technologies so that at least everyone will have access to them. Likewise, biohacker Josiah Zayner[8] started a company (The ODIN) to selling DIY CRISPR kits for home genetic modification in order to ensure the technology exists beyond the "hands of wealthy corporations," concluding that "I don't think you can stop it and so instead we should figure out ways to make it accessible and safe" (quoted from D'Monte 2018).

Other grinders are not far behind in their enthusiasm for putting augmentation, as both survival and self-expression, into the hands of the people. Grindhouse Wetware engineer Marlo matches Rich's excitement at the possibilities:

> That's what I really want to see, man. I want to see people stop being like, how can I *use* this, and being just like, what can I *do* with this? Like, make it art instead of science. And then people -- especially these days -- put so much stock in looking pretty and perfect, where it's like we could look like anything. You could. You could give yourself a dog face or have fucking mouth tentacles, or, I don't know, dick nipples or something. It's endless. There's literally like an infinite amount of permutations of the body that we could potentially do, most of which would just be for fun, and there's nothing wrong with that. It's great. (Marlo)

[8] I don't know if Zayner considers himself a grinder per se; I did not interview him for this research. In my opinion, his work is at least 'grinder-esque,' and he does run in similar circles. I have met Zayner personally, though here I only rely on his public statements, which reflect many of my informal interviews with other grinders.

That grinding is still far from mainstream is often part of the appeal for those who partake, hoping to get "an idea what to expect" in the future (Jordy), and maybe even shape our cognition of "what's going on, or […] what we are or what we're thinking" (Zac). It was clear to me grinders hope that reducing societal constraints for body enhancements will both provide options to the general public and thus facilitate undermining normative conceptions of the body. In practice, this gets complicated when societal constraints are more substantial than expected.

Though the rest of this thesis is devoted to grinders pursuing their projects and the challenges they face in this respect, it is worth relating a short encounter between grinders and 'non-grinders' with respect to what might happen with increased options for bodies. It started with an inquiry made to the biohack Facebook page in 2015: "What's the safest way to go from being black to white or Hispanic? In order to change my race, I would have to change my skin tone and hair texture. What else would I have to change?" Rich and Jeff each replied with some scientific possibilities along with relevant health concerns. The original poster then added his reason was he didn't think black people were treated fairly on the dating scene. He further argued "No one should feel preasured [sic] to support a community just because that's how they were born." Rich replied how he agreed with the original poster about the unfairness of judging by race, and expressed his intention to help. Jeff chimed in, suggesting the person could change his skin colour to blue, to which the poster's final response was:

> I don't see blue people as having a good social life or sex life unless I can find a REALLY relaxed and/or progressive environment. The more alien I become, the more I'll have to be satisfied with being alone. Blue would be interesting but I don't want to go crazy that fast. A change that drastic would have to take a while before it caught on (or so I would assume). I at least want to appear human.

What grinders want to happen and what the average person wants may not accord, and this conversation is not promising. It is a prime example of how grinders operate according to a pre-emptive logic that "operates on a prototerritory tensed with a compelling excess of potential which renders it strictly *unlivable*" (Massumi 2015a, p. 40, emphasis original). Grinders perceive technological advances as inevitable, so they want to ensure these technologies are accessible to the average person to prevent inequality. However, grinders have no control over

whether the average person uses that technology to instead reinforce normative body constraints. By bringing about the very conditions they hoped to pre-empt, grinders may end up supporting the very inequalities they sought to disrupt. If it is a grand theft, then of whose future?

Conclusion

Ultimately, Jeff settled on the ghost town of Ballarat, California, for the location of Grindfest Three. Far enough from any trace of civilization, its sole remaining occupant maintains the premises on behalf of a mining company, thus avoiding any problems with Bureau of Land Management authorities. For a couple dollars each, the elderly caretaker tells us, we can shoot guns, do drugs, drive cars into each other, blow things up, get naked; it doesn't matter to him. Anything to encourage business at the small shop he runs, which boasts various memorabilia from town history, apple pie moonshine, and a dozen cans of warm soda kept in an old, non-functioning freezer. Charles Manson's broken down Dodge Power Wagon is parked on the gravel mere metres away. Years ago, some of his victims and weapons caches were found buried in the area, and maybe more are still out there. It'll be perfect for a grinder paintball battle, Jeff figures, during a new moon when visibility is reduced to nothing, forcing participants to innovate to avoid any traps he sets.

Remix culture has no stable past, and its pre-emptive present acts by grand theft future. DIY seems the only route possible for grinders, but this approach does not obviate structural obstacles. Grinders' pessimism towards medical, scientific, and private institutions is only partially balanced by their semi-forced optimism derived from emerging technologies. When institutions (and their accompanying discourses of, for example, 'health,' 'human') are undermined by emerging technology, there is "no need to fear or hope, but only to look for new weapons" (Deleuze 1992, p. 4). If there is one rule of grinding is it this: do not let anything get in the way of grinding. This means politics, materials, money, access to information, and even the body itself. But in an informational climate where distrust of institutions is attributed to their control over what is visible, how do grinders build trust amongst themselves as they navigate the excesses of remix culture? The next chapter is about how this information storm works in practice through a historical/genealogical account of the grinder scene.

Chapter Four
The Mediation Machine:
Scavengers, Scrapheaps, and Subterfuge

> *Let us observe a dog and a child who have lost their master on a highway: the child cries and does not know to what saint to pray, while the dog, better helped by his sense of smell than the child by his reason, soon finds his master*
>
> De La Mettrie, (1961[1748]), p. 114.

In chapter two, I outlined grinders' perceptions of bodies being weak and unsuited for coping with immanent modern threats. In chapter three, I explained how grinders confront the perceived weaknesses of the body with an effort to seize emerging technologies outside of traditional institutional means; if they can liberate themselves from institutions they may liberate their bodies. What ties the grinding scene together is thus the effort to improve bodies oneself (i.e. DIY). But grinders do not pursue this goal all in the same manner. Unlike the previous two chapters, which delineated what draws grinders together by their likenesses, this chapter examines how they are drawn together by their differences. At the centre of how disputes are formed and resolved (or at least continue despite irresolution) is the aggregator of all things grinder: the internet. The internet is where the grinder movement began, and given grinders' geographical dispersion it is often their only way of participating. But as this chapter will demonstrate, there is a difference in the practice of grinding for those who are able to meet in person as compared to those who are not, and the effects of this difference reach from the integrity of the community to the implantable devices themselves.

Since grinding is a subset of bio*hacking*, our first instinct might be to think about its parallels to computer hacking. Indeed, some grinders consider themselves *wetware* hackers, thus positioning themselves as cousins to their digital counterparts. Both wetware and computer hackers exude a commitment to challenging intellectual property by making knowledge free with hopes to stimulate further ideas, both champion free speech, both are dedicated to understanding the minutia of their medium that makes it 'work,' and both pursue unconventional and creative solutions to achieving these ends (see Coleman 2013; Jordan 2008; Levy 1984). Most importantly, both target vulnerabilities and attempt to "push technology beyond what it is

supposed to be doing" (Jordan 2008, p. 4). In 2015 one of the largest computer hacking conferences in the world, *Defcon*, first included a biohacking 'village.' About a dozen grinders participated in presentations and running the village's logistics, hoping to raise interest from those on the software/hardware side of hacking. The popular promise of computers (and networking in particular) as a tool of democratization, where technology and the ability to communicate is placed in the hands of the workers[9], is evident at Defcon and shared by at least a minority of the grinder scene. At Defcon 24 in 2016, a handful of grinders and I watched one of the conference's main speakers explain how to overthrow a government through computer hacking[10] – hypothetically (yet in surprising detail), of course.

Somewhat at odds with a revolutionary hacker ethos, a second parallel might be drawn between grinding and the open-source software movement. Grinders with little interest in the illicit or grungy 'cyberpunk' approaches may be more sympathetic to the "reformation over revolution" response found in open-source movements, where collective publics hope to challenge or bypass prohibitive established institutions (Kelty 2008, pp. 66-74). According to Feller et al (2005) open source software requires the user ought to be allowed to use, modify, and redistribute their product "in any manner they see fit" (p. xvii), a sentiment echoed in particular by members of Grindhouse Wetware (see ch. 3).

In practise, however, applying the concepts of hacking and open-source to wetware is complicated by the body's substrate. The material differences between between software and wetware are compounded depending on whether a grinder views the body as revolutionary, open source, or a medium for expressing a lifestyle (and in particular the consumer lifestyle as imagined by Giddens 1990). I suggest these differences become clearer by accounting for how the internet mediates grinder interactions between on- and off-line activities. To understand how the internet works as a mediator that facilitates, shapes and at times opposes grinding as a community, in this chapter I trace its functions through the stories people told me about the beginnings of biohacking. These stories are further supported by an archaeology of digital artefacts from various locales of the internet, as well as complicated by my own ethnographic

[9] For an overview and critical response of such views, see Andrejovic 2007.
[10] The presentation is available here: https://www.youtube.com/watch?v=m1lhGqNCZlA

encounters. It is, of course, a remix[11]. I begin with an historical account of grinders online, showing how it builds a world of promise for grinders. Next, I consider how certain aspects of grinding cannot be achieved online. Finally, I trace the connections between on- and off-line, demonstrating how contradictory efforts are twisted by economics, libertarianism, and neoliberalism; individuals and communities; friends, well-wishers, strangers, co-workers, provocateurs, and competitors; communities and scenes; and digital and analog bodies. Ultimately, I demonstrate how grinders mobilize and, more importantly, are *mobilized by* the internet.

But first, because the grinder scene exists in a hybrid of both physical and virtual space (Virnoche and Marx 1997), a brief note on terminology is required for clarity. The terms 'actual,' 'physical,' 'real,' or 'offline' are often used in contrast with 'virtual' or 'online' activity (Nardi 2015). In studies of the virtual realm, Nardi (2015) argues the term 'offline' can suggest "too specific a break" with either 'virtual' or 'online' (p. 20). In the case of grinders, however, I think this break is appropriate since the type of work that takes place online and offline is readily distinguishable, even if they are intrinsically related. Clearly, both online and offline are 'real life,' as they both take up time and space, and activities in either can have lasting consequences for the other. However, the offline realm is distinguishable because it is *visceral*, meaning it contains "the domain of experience in which bodies live, feel, sense, exert, rest, emit, ingest, relate and change" (Hayes-Conroy & Hayes-Conroy 2015, p. 659). Though this terminology is not perfect (and will become increasingly complicated by the proceeding chapters), it is a useful place to start.

Grinding on the internet: Lepht is right

The beginnings and eventual growth of the grinder scene has a lot to do with Lepht Anonym, author of the *Sapiens Anonym* blog. The blog was one of the first online spaces to actively pursue the idea of grinding or body biohacking as a group. One of the first posts significant to the history of grinders occurred in 2008, where Lepht detailed implanting an RFID

[11] During the course of writing this chapter, certain web-links with perhaps questionable content were deleted by their authors. Though these sources are still available through internet forensic tools (as well in my personal data backups), I have removed such references out of respect for the authors.

chip. The explanation began with the reasons for choosing that particular chip, and then moved on to how it was done:

> why i did it this way, in a student bathroom, instead of having it shot in like a normal... dog whose owners don't wanna lose it. like i've yelled about before, .gov health services won't do this sorta thing for a few reasons: takes up real patients' time, isn't medically necessary, i might sue (yeah...) there's no vet in my part of town, and i doubt they'd do it anyway, so i was left on my own...
>
> (Anonym 'Meathacked' 2008)

What followed were step-by-step instructions, from purchasing the chip to sterilization to insertion, and ending with a celebratory shot of alcohol.

In the following months, Lepht documented experimenting with magnet implants, having the first one performed by a professional piercer. The second attempt was performed by Lepht and a friend on each other, and marks one of the more controversial and defining stories of grinder history due to their use of a kitchen paring knife to make the incision. As recorded on Sapiens Anonym, they had a scalpel available but the sterilized paring knife simply worked better for the task at hand (Anonym 'I'm an idiot' 2008). This fact was usually left out of the story when repeated to me by others, possibly because it interferes with the 'cyber-punk' aesthetic of dangerousness or 'edginess' that I've noted some grinders enjoy. Even though Lepht is obviously not responsible for others' omissions, the risky-but-worth-it attitude is congruent with the aesthetic that Lepht propagates elsewhere.

For example, in 2010 Lepht retold this story as part of the 27th Chaos Communication Congress (27C3), a video of which was later uploaded to YouTube. The presentation emphasized two main points. First, anything can be made into a sensory device so long as it fits under your skin and can stimulate nerves. Second, self-modification can be done for a low budget, so long as some pain is tolerated. In Lepht's words, "I'm not a doctor, I'm not a lawyer, I'm not shit. I'm just Lepht," and later added, "…so I sat down in my kitchen with a vegetable peeler, I shit you not, and I decided to put things in my hands. The first time I ever sat down it went horribly, horribly wrong. The whole thing went septic and I put myself in the hospital for

two weeks. It was not very pretty, so, lesson learned. Sterilize everything. Sterilizing everything with vodka if you have to, but make sure you get everything."

That same year Lepht wrote an article for H+ magazine detailing "scrapheap transhumanism," which concluded with a call for collaboration:

> Turn off the TV. Pick up that needle. Come to the junkyard.
> Watching commercials for vitamin pills on TV and thinking you need a mad scientist's lab to be a transhumanist? You don't. I've got no money, talent or backing. You just need curiosity and the willingness to withstand some pain. Risk, not money, is our obstacle. Is it yours? Are you reading this magazine right now? Do you think like that? What could we achieve together? ('Scrapheap Transhumanism' 2010)

The 27C3 video and the H+ article were quickly picked up by other tech news outlets such as io9.com and wired.com (the latter of which has long promoted the technological as an emancipatory-libertarian-digital-revolutionary utopia; see Turner 2006), and later spread to a reddit.com discussion. These articles increased the visibility of the Sapiens Anonym blog, and over the next year or so a small following slowly built up in its comments section. People began discussing how to source and implant their own magnets, and collaborating on new projects and bioproof coatings. Through Sapiens Anonym, the foundational ethos of grinding developed: body modifications can be done yourself, in your home, it doesn't have to be expensive, and risks can be managed by sharing information.

Though Lepht's call for scrapheap transhumanism can be considered precursor of the grinding scene today, the comments section of the Sapiens Anonym blog ultimately was not organized in a way conducive to group collaboration. Every time Lepht made a new post, the discussion in the comments section had to begin anew, thus disrupting continuity. Moreover, as the blog gained visibility it also attracted more attention – both positive and negative – which demanded responses that consumed energy that otherwise could be spend collaborating.

Concurrent to the rise in popularity of Sapiens Anonym, there were also discussions of DIY biohacking taking place on the *Humanity Plus Roadmap* Internet Relay Chat (IRC) channel. Unfortunately, the format of IRC creates difficulties not only for grinders attempting to organize, but also for myself as a researcher due to its ephemeral nature. Messages are not automatically

saved or archived, so without logging in (and staying logged in) it is impossible to conduct a genealogy or catch up on any missed conversations. My interviewees generally remembered it as a transhumanist group with a political tone, and far less action-oriented than they desired. When pressed for more specific details, they noted how the discourse at times became animus, as nascent grinders accused other transhumanists of being smug and ineffective, while transhumanists accused grinders (and sometimes Lepht specifically) of giving transhumanism a bad reputation through irresponsible experimentation. There is also extant digital evidence of this tension elsewhere[12]. Though IRC was credited as a productive venue for debate, grinders needed an online venue where like-minded people can get together to get things *done*.

Birth of biohack.me

The shortcomings of Sapiens Anonym comments section and IRC created demand for an outlet for "people that were more interested in the kind of edgier side, like what we can do right now" (Marc). As a result, the biohack.me forum – "the heart of the biohacking community" (Jacob) -- was launched in mid-January of 2011[13]. Its initial members emigrated directly from both the Sapiens Anonym comments section and Humanity Plus Roadmap IRC channel. Rich Lee, who was active on all three formats, and others set out to recruit interested and talented participants for biohack.me. Expertise was not necessary, but it was definitely welcome. Following Lepht's lead, if grinding can be done with vodka and a vegetable peeler, then by crowdsourcing via group collaboration the possibilities might be safer and more effective.

The organization of biohack.me not only provided temporal and spatial stability to conversations, it also allowed its creators to reimagine what exactly is involved in grinding. The forum was hoped to be something like a recursive public, that is, "a public that is vitally concerned with the material and practical maintenance and modification of the technical, legal, practical, and conceptual means of its own existence as a public" (Kelty 2008, p. 3). In addition

[12] For example, see Clark 2012. Another post on the biohack board, "Why are transhumanists suck dicks?" (2014) was the source material for a sparse article on Boingboing (Parks 2015) whose comments section spilled over into a small reddit argument ('Why are (some) transhumanists…' 2015)

[13] Originally, biohack.me was launched more or less contemporaneously with selfmodifier.org. The former was intended for discussions, and the latter for detailing projects. Selfmodifier.org lasted only a short time period, with biohack.me quickly taking over both purposes.

to having specific discussion posts for existing projects, there were also categories for potential projects like genetic modification. Even though original member Ian readily admitted genetics were "kind of out of our reach" at that point, they also signified intentions for how and where to push the boundaries of grinding in the hopefully near-future. Indeed, the nascent days of the forum had an "air of impatience," as Marc described it:

> Oh, god. It was really fucking exciting. It was like -- it reminded me of the early days of the internet just how fucking wild and crazy and unregulated everything was. Like, people were posting pictures of getting neodymium implants and RFID chip implants and, yeah, it was the wild west the first couple months because people were actually doing it. And it was really surreal, you know? You play make believe as a kid, you write science fiction stories, and there's a part of you that's like, okay, but that's all bullshit, but I've got to get a desk job at some point, you know? And seeing this actually happen, seeing what you put into the world grow, and that way, at least for me at 18, 19, 20, was really surreal.

There were some boundaries, however. Early members, and Rich in particular, were adamant on preventing biohack.me from becoming yet another site for transhumanism debates, a hyperlink depository of exaggerated 'pop-science' articles about how great hypothetical technology will be, or a place that tolerated woo. Endless speculation, he says, "doesn't do anyone any good; I'm just concerned about the tech" (Rich). In the first few years, it was rare for a discussion thread to be closed by the moderators; however, if anyone tried to post something political they'd be quickly dismissed by other posters. In Rich's assessment, most people quickly caught onto this culture.

I began checking biohack.me almost daily in early 2012 and continued to do so up until the publication of this dissertation. Though social regulation has somewhat relaxed since I first visited, the anti-political culture remains. For example, in the months leading up to the 2016 American elections, writer and biohacker Frank Swain created a post asking "Who is the grinder candidate – Trump or Clinton?" The first four replies, all from long-time and/or frequent posters responded:

> "None" - Meanderpaul
> "A.I. for overlord 2016. Let's just say I'm glad I'm missing the voter registration window by a few months..." - ChrisBot
> "No. The answer is No." - glims
> "An honest appraisal? My foot would be a better grind-oriented candidate than either." – TheGreyKnight

A half-dozen or so responses of mixed seriousness followed before the thread was closed to further discussion.

By avoiding the overtly political, the bulk of the content of biohack.me centres around connecting ostensibly do-able ideas by recontextualizing a variety of concepts within the body, and ultimately working towards getting things done in the *real* world. Take for example one of the longest threads (post count and time-wise) on the possibility of subdermal armour, which began in August of 2013 and continues into 2017. In considering the general feasibility of such a project, the materials, form, purpose, application, and supporting data reconfigured the project as the discussion continued. At first it involved plates made to follow the natural contour of the body, but then it was noted plates may lead to implant fouling (i.e. coating failure leads to hemorrhaging leads to clotting leads to stroke), as well as cutting off blood flow to the skin and interfering with the body's heat dispersion. Abandoning bullet resistance for other defensive features, they next considered smaller reinforced fabrics, 'fish' scales, and/or thickening the skin. Ideas were supported with links to academic research papers, military websites, a picture of a pangolin, chicken feathers, and even references to comic book characters (Wolverine) and video games (Deus Ex).

Scholars have noted how online or virtual realms are useful for working through and imagining ideas about the self and identity (De Mul 2010; Long 2013). However, even when grinders referenced comic books or video games they still grounded their discussions in their visceral bodies, exploring ways of bringing the incredible to the practical. Science fiction can be cited for ideas, but those ideas will be quickly shot down if their application is unrealistic. This suggests biohack.me is less a virtual world grinders are 'in' and more a website that they go 'on,' where the ontological gap between imagined and real is to be as narrow as possible (see Boellstorff 2011, pp. 510-513). In other words, while biohack.me is a central node of

imaginative interaction between grinders, it cannot give a full account of how grinding works as praxis.

On the one hand, biohack.me is an important site for affective and immaterial labour, in that it produces transnational social networks and forms of community, as well as ideas that create a market for its products (Hardt & Negri 2001, pp. 289ff; Terranova 2004). On the other hand, the application of these ideas must take place offline. Most projects discussed at biohack.me are never attempted in real life; they remain 'vapourware' because few people are willing or able to translate the ideas into a body without offline support. One hindrance to getting beyond vapourware is that expertise is required for the non-Internet activities, and the geographical diffusion of grinders makes it hard to get anything done. Among the most common posts on biohack.me are those looking for implanters in their area. Not everyone is comfortable with cutting themselves open, and, even more practically, it is difficult to suture one hand with the other.

Given these practical difficulties, it is no surprise that most biohack.me threads, no matter how promising, tend to go quiet without explanation. The early days of the forum established a "give us something or get out" attitude (Rich), but when there is nothing to give then there is nothing to post. The lack of documented progress resulted in cyclical dead periods of diminished forum activity, an occurrence especially prominent in the first several years of its existence. Marc recalled the early days when grinders were having a hard time finding ways to get beyond RFID and magnet implants. The ideas suggested on the board too often exceeded the available technology or expertise. Simply waiting would make them no better than the much-maligned transhumanists. Moreover, an offline perspective is sometimes necessary to both gain perspective of how the online realm works and also develop relationships of trust (see Xie 2008). Despite the optimism of democratically sharing of ideas on the internet to bring information into the public realm, it makes a difference when grinders have physical, real life interactions to make their ideas happen.

Grinding on the outernet: What the web won't do

The internet is not only a place to work through ideas, it also facilitates offline connections that would otherwise not have been possible (Miller and Slater 2000). During one particularly slow period on biohack.me in the late summer of 2011, Ian and Marc began to

interact through a Mumble server and Google+ hangouts[14]. This proved productive, as "being able to talk to each other in real time, that allows you to work things out in a way that just a couple of forum updates every few minutes or whatever doesn't get you" (Ian). In initial discussions they put together a list of projects they wanted to work on, including building a device to convert range into electromagnetic fields to interact with magnet implants, potentially considering genetic modifications, as well as continuing the 'southpaw' implanted compass project that had originally started on the Sapiens Anonym blog. Not long after these chats began, Tim Cannon joined in the discussion. As it turned out, he and Shawn Sarver had already built a range conversion device called the Bottlenose.

The group began regularly working together on developing the Bottlenose. As the team membership expanded, they decided to take advantage of Tim's professional project management skills and form something of a company-like structure to better achieve their goals. The result was Grindhouse Wetware (GHW), what is now described as a "dedicated team working towards a common goal – augmenting humanity using safe, affordable, open source technology" (grindhousewetware.com). Though Grindhouse has members who work remotely, it is also defined by a physical lab space in Pittsburgh. In doing so, the production of grinding extended from the internet into what Terranova (2004) calls the *outernet*, made up of "the network of social, cultural and economic relationships which criss-crosses and exceeds the Internet" (p. 75).

On a smaller scale, the emergence of GHW as a named entity provided a sense of stability to participants. It exists in a liminal space bridging on- and off-line that exemplifies how productivity works for grinding in general. Speaking to each online other facilitated group cohesion, but having a physical space magnified productivity that even attracted members to relocate to Pittsburgh. Beyond being able to share tools and resources, the social benefits were paramount. When Marc moved to Pittsburgh to live at the lab, grinding to him became "very real, very quickly," and he described how sharing a space with other members created an energy that could not translate through a digital medium. Suddenly, "instead of having to schedule a Skype call with Tim, I was waking up and coming down the hallway and there we were, having a

[14] In brief, *Mumble* is a voice over Internet protocol (VoIP) application. It functions more or less like a telephone conference call using internet infrastructure. A Google+ hangout is similar, but also allows video.

pot of coffee, you know, just hashing shit out […] The productivity of it just shot through the roof."

After Marc left Grindhouse to pursue other interests, Marlo took up residence at the lab as frequently as his Australian passport allowed. Marlo echoed Marc's enthusiasm for the productivity afforded by the physical presence of other members, and in particular Tim:

> Seeing as he is the guy that writes the software for my implants, we need to reach compromises, and just being able to bounce little things off him, like should I do this setting with this instrument? Do you think this is an appropriate charge rate for the battery? Little, tiny questions like that, that are super critical to my design that I just need to bounce off somebody to get a yes or no, is this a good idea or stupid idea. Then I can sit back down and start working again. Because if I try to send him a message he won't reply for days, and it's days of me sitting on my ass just waiting to see if I should shift this one thing an inch to the left or an inch to the right. Yeah, it's really frustrating, actually. (Marlo)

Being in physical proximity to other grinders is instrumental to project momentum. The blogs, forums, and comments sections had always attracted people who were interested in human augmentation, but putting a name and a place to grinding as a 'movement' provided it a certain gravitas. Marc even admitted, "we weren't doing anything terribly remarkable. It was just that we were the first, and we were the first people to really come out of the shadows, and that effect was huge on people." Being able to experience what is happening in person produced a different kind of sociality that did not exist online. In fact, Justin became Grindhouse's CEO after hanging out at the lab long enough for them to recognize his business and organizational acumen.

This is not to say that those who participate in Grindhouse remotely, like Ian and [Jes], are not significant parts of the scene, but they do face some disadvantages. Ian doesn't see the spatial separation as a big deal, although he did note potential discrepancies in the prototypes he uses to test coding and those used in Pittsburgh can be problematic. Jes further pointed out to me that as much as computers facilitate communication, they also create distractions. "It's easy to say, well, I'm going to work on this but I need to wait for this to download so I'm just going to

play [the video game] Starbound for the next -- oh, it's accidentally five hours later." Fortunately, being based out of Boston, Jes lives close enough that she can periodically drop by the Grindhouse lab to work in person, which she finds keeps her more accountable, as well as streamlines problem-solving and brainstorming.

Because Grindhouse organizes its activities largely through the internet (and in particular through Slack software[15]), I found that asking who its membership consists of left me unclear. I was only hoping to identify potential interviewees, but my questions also unearthed questions of inclusion. Those with a physical presence in Pittsburgh were always named, but beyond them Grindhouse could consist from a handful to over a dozen. One person named as a member later explicitly told me they were not. Perhaps little turns on this, as individuals may be more or less involved or committed to Grindhouse as an entity, which can be interpreted differently. It could also have been a simple mistake. I include this because in my experience of on/offline collaboration between grinders on the west coast and elsewhere there were similar problems with accountability and group cohesion.

While there is currently no named grinder collective entity on the west coast, there have been a few efforts that fizzled out rather quickly. For example, Jeff has tried several times to form groups for online collaboration and/or accountability. Whether a dedicated study group, or simply trying to keep people updated on personal projects, there is always a decent sized group expressing interest, a handful that participate, and then inevitably participation drops until the effort dies out. In late 2015, Jeff posted on biohack.me he was starting a study group to learn about cells and tissues, with a focus on developing new grinds. Eight expressed interest, three (plus Jeff) tuned in to the first call, and thereafter only Jeff, Amanda, and myself remained. Similarly, in the summer of 2016, Jeff initiated a series of group Skype support calls, but after several weeks where he personally started every call, there was one more call started by myself, and then the calls stopped when no one else was willing to take responsibility.

In contrast, every west coast in-person meet-up is relatively well attended, despite being essentially the same people invited to the Skype calls. This could be in part due to their infrequency, with events like Grindfest or Defcon only being once a year each. Yet it cannot be

[15] Slack is a cloud-based software that facilitates collaborative digital tools and services.

entirely a question of commitment, since it is much less effort to sign into Skype for 30 minutes than it is to drive out to Tehachapi or Las Vegas for an entire weekend.

There is something important about sensory interaction that is absent over the Internet. For Cyberlass, in-person meet-ups are essential for making sense of what happens online. "Especially like at Grindfest, you're actually seeing each other face to face and that's a different interaction. I noticed a couple of times people are like, oh, that person's not an asshole – nice. They […] come across that way on the boards because you don't have enough emoticons to convey the niceness if you don't smile." Having met in person allows a recontextualization of not only future digital interactions, but also previous interactions.

> Oh, yeah, there's definitely a bunch of times that I've gone on [biohack.me] and the handful of threads I have commented on, I'll go back and look at the people who I was talking to. It's like, oh, shit, I was talking to Cyberlass. I know who that is now, holy crap. (Justin W)

Real life interaction over exclusively digital interaction is especially productive when initiating collaborations. The most fruitful collaborations in the grinder scene have had a large degree of physical proximity: Grindhouse in Pittsburgh, west coasters near Tehachapi, as well as smaller collaborations in Utah by Rich, Stephen, and Ben (who also tend to make the six- to nine-hour drive out to Tehachapi). Being face-to-face is more than just seeing a person; it is a multi-sensory experience.

> I think that's super beneficial, too, because talking about things online is good and it's awesome that we can find other people to talk to online like that, but it's also not the same as, you know, sitting down over a pitcher and talking about what you're working on or what you see as being a good idea or how things could happen, or how we could make things better. (Stephen)

In my experiences with grinders, being inebriated in a group of like-minded people makes it easier to come up with new ideas, and it also provides an easy excuse if someone crosses the line (interestingly, political talk amongst grinders is not uncommon at gatherings). Certainly, some

things that happen at Grindfest are never to be repeated, and not repeating them establishes trust and openness between the attendees. Strangely enough, in this sense there is more anonymity in person than online, where anything posted may be captured for eternity. For myself, the most important aspect of in-person meetings was observing how people respond. It was not just about putting a face to a name; it was about being able to evaluate who is serious about what they are saying.

But not everyone can meet up in person, and even those who can are mostly restricted to the few yearly events. Most of the people, most of the time are excluded from the benefits of off-line sociality, and this affects the production of grinders in subtle ways that undermines how information flows between both on- and off-line intentions.

Grinding in between: The mediation machine

As much as grinders organize themselves via the internet to further their DIY projects, the internet also organizes them. What has been presented up to this point is only how the internet works as if an *intermediary*, which is to say I have described how it "transports meaning or force without transformation" (Latour 2005, p. 39). In the first section, I traced how the Internet has been engaged according to grinders' accounts, where it is viewed mostly as a tool for both sharing information and organizing like-minded people. I then delved into the outernet to demonstrate that some aspects of grinding -- namely, degrees of both productivity and evaluation -- that either do not or cannot take place online due to material limitations. However, to speak only about the role of 'the' internet (and in particular the optimistic view grinders take of it) is to overlook the multiple ways it functions as a *mediator*, that is, how it transforms, translates, distorts, and modifies meanings along the way (Latour 2005, p. 39). On- and off-line activities of grinders are not entirely discrete, and information circulates between them in a way that works for and against both the ideals of grinding set out online, as well as the collaborative intentions established offline.

One way to conceive of this dynamic network is to trace the material links between the Internet and bodies. As a practice, grinding requires physical parts, tools, and/or chemicals, and these are often cost prohibitive. Either due to necessity or out of principle, grinders have developed a few strategies to scavenge for resources. Sometimes this means raiding Costco's photo development department for the capacitors from discarded camera flashes, or attending

after sunset to a parking lot of abandoned appliances to extract refrigerator compressors. On our habitual trips to the municipal dump, Jeff would retract the roof of his Mustang and slow down as we drove past the electronics section, with one eye on a potential fortune and the other on the junkyard guards. But most do not take 'scrapheap transhumanism' so literally.

One of the main draws of grinding is that it boasts the possibility of choosing for oneself the goals, materials, rate of production, methods, and so on. When Grinders have limited means to build their projects as imagined, they turn to the digital scrapheap of the internet to gain an advantage. With mediators, however, the "input is never a good predictor of their output" (Latour 2005 p. 39), and this is especially true when grinders approach the internet to get what they want, but instead get something that merely *looks* like what they want. While the internet may provide access to materials and ideas, it does so in a way that shapes not only which grinds are pursued, but also how they are made, and, most importantly, the social dynamics of the grinder community as a whole. Specifically, I approach this problem by tracing the mediations through reputations, regulations, and (anti)collaborations, demonstrating how the internet contributes to a culture of information retention rather than sharing.

1. Reputations

Though grinding was originally imagined as a collaborative effort of shared information, it did not take long for it to be absorbed into the digital economy and its concomitant issues of production. As it turns out, there is a good reason open-source software tends to be distributed without a warranty, even (or especially) when it is done so in hopes of achieving a wider audience. In broader hacker culture, software is generally distributed as 'open' or 'free' to emphasize "the right to learn and access knowledge" (Coleman 2013, p. 3). I argue this goal is impeded in wetware hacking because it necessarily involves visceral bodies. As Leslie pointed out, the stakes (and mistakes) of modifying computers and bodies are fundamentally different. "Oh, it screwed up the machine? You can just boot in another one and start again. […] You can't really try that with a human and say, hey, let's try this on a human. Oh, they died? Well, start again." As a result, how information flows on- and off-line is heavily influenced by the precariousness of identities and reputations that are mediated by informational flows through the internet.

To begin, preserving the reputation of the scene creates tensions about the limits of self-regulation. If someone does something risky it can create lasting negative repercussions for others. Ben reflected on this relationship when experimenting with more affordable biocoatings for magnets:

> There are a lot smarter people than I doing it, so I was the dumbass who came along and was like, hey, I found this stuff, I'm going to do this in my kitchen, *watch*. And then I was just lucky and so far it's working out for me. And then people on the forums are saying that now they're doing it, which scares me, but at the same time I think it's almost good. I don't know. I'm in a weird state because I think if people fuck it up then that sucks for everybody.

A pervasive example among the grinder community is the use of Sugru as a bioproof coating for magnets. Sugru is an affordable silicone-based adhesive that hardens upon contact with air. Lepht used it to biocoat early experimental implants (Boreland 2010) and for a couple of years it was one of the go-to cheap DIY coatings for grinders. Unfortunately, tests done in 2014 by grinder collective *Science for the Masses* learned Sugru is, in fact, not bioproof and will disintegrate when implanted. These results were shared on biohack.me and cited frequently by posters whenever the subject came up. Nonetheless, occasionally (and as recently as 2016) a new poster on biohack.me will implant a Sugru-coated magnet, likely relying on old information still 'out there' on the web.

As evidenced by Ben and the Sugru example, sharing knowledge about behaviours risky to bodily integrity forces reflexivity about where responsibility lies. It would be hypocritical for grinders to condemn the experimentation of others, but there is also anxiety that condoning reckless behavior will somehow impinge or impede upon future experimentation. In person, at a laboratory, or at Grindfest the outcomes are not only more controllable, it is possible for immediate (re)action in imminent dangerous situations. I think a large part of the experimental freedom at Grindfest is made possible by the knowledge that some attendees are medical professionals. The difficulty, of course, is these problems are uncontainable once online.

Alternatively, the internet is also used to protect or conceal grinders' reputations when dealing with uncooperative sources who will not work with grinders. Many companies, whether

they are selling proteins or medical devices, or providing silicone coating services, have a variety of techniques to ensure their products go to a certain kind of customer, which frequently precludes grinders. Jeff once tried to order a compound that looked promising as a biocoating, only to have the manufacturer respond that they would be happy to first send someone down to show his business how to properly use it. He declined. Jeff has also been rejected because his mailing address lacks proper zoning for commercial purposes, or because the business demands 'papers of incorporation' before the sale can be finalized. Even more straightforward, Justin told me a company rejected Grindhouse's business because it was "a little too DIY for us," and without elaboration abruptly hung up the phone.

But larger companies using these techniques as a screening device can sometimes be subverted through the (in)visibility of the internet, thus protecting grinders' reputations.

> That's all a bit of a shitfight. A lot of times I use a brute force method where I do research to find every company in the world that does this particular service, send an email to all of them asking them to do my thing, and then filter through the handful of replies I get back. If that doesn't work I make a fake email account with a fake name, change my wording and try again until it works. (Marlo)

Grinders have attempted to get around rejection by playing with their language and being vague about their applications. When Stephen was soliciting companies about coating magnets for implantation, he made sure to be "sort of vague about the use in the initial emails but very specific about the requirements." Grindhouse has also had success by claiming their application was some sort of scuba gear prototype. The most productive business relationships, as Jes puts it, are those where "they don't ask questions, we don't give answers." Sometimes being vague leads to unexpectedly positive connections:

> A lot of times I'll just email these doctors, or people who wrote papers and things like that and just ask them questions. And it's funny because a lot of times they'll email me back and they're like, oh, thank you, Dr. Lee, and this and that. They think I'm like a doctor, another professor, something like that, or a colleague. And they'll just spill everything, and they'll answer questions […] like, oh, hey, we're glad you're

interested in this, and check this out … (Rich)

But just as grinders can misrepresent or underrepresent themselves to achieve their goals, online companies do the same to grinders. For example, grinders will often try to offset project costs by bargain hunting across internet marketplaces such as the Chinese e-retailer Alibaba.com. These retailers have cheap electronics parts, though shipping times are measured in months and their products are of unpredictable quality[16]. Around 2014, Ron ordered some glass RFID capsules from Alibaba that he was considering implanting. He and a friend decided to test it first.

> That was testing it and checking for little pores or anything in it, and trying to figure out if it was good, and that was when we pulled the microscope thing up a little too high and it cracked right away. Just shattered. And he's like, I hope you're not putting one of these in your skin. And I was like, not anymore. (Ron)

While the internet offers deals, the deals become potential risks for all involved. There is no way to know the quality ahead of time, and as a result it requires time to test for safety. Unfortunately, there is no guarantee someone else will take this required time. Zac tells me he is "a little surprised that nobody's died yet because […] most people don't really know what they're doing. They just see something online, be like, 'that's super cool,' order it, and then cut themselves open and shove something under their skin." In the course of selling RFIDs, Amal tells me how he is frequently emailed questions asking, "I got one, it's implanted, now what do I do?" A lack of foresight is not enforceable when there is a disconnect between the online information and offline practises.

Even Grindhouse Wetware, who are outspoken proponents of open-source, run into difficulties when it comes to getting their product into customers' bodies. They insist their Northstar implant, which has a diameter of slightly more than a 25 cent coin and a depth of about a quarter inch, requires professionals for installation. "No one is obviously capable of putting

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[16] Alibaba.com in particular is popular among grinders. In both 2012 and 2016 it made the "Notorious Markets" list of the *Office of the United States Trade Representative* due to its high volume of counterfeit and pirated goods (2016, pp. 12-13)

these things in themselves, and if they are [self-implanting, then] we don't trust them," says Marlo. Northstar implants are only available through body modification artists that have been vetted by Grindhouse. This is not only to make sure they are implanted safely, but also to hopefully avoid liability issues. "It's like a leap of faith every time that nothing goes wrong," Marlo adds, "but this is one thing we can do to make sure that things are less likely to go wrong." Justin further elaborates:

> We're just mainly concerned; we don't want average people getting them at the moment and then just going out and getting a scalpel themselves and cutting themselves open because -- even though that is originally what grinding was -- we do have liability concerns that we have to deal with. So we do have to look at safety issues. I mean, if anyone gets hurt using the devices or trying to install it improperly, or doesn't have the training to do it, we don't want to have to deal with the media bullshit, possible legal bullshit, so it's just really -- at this point we're still too young of a company to be taking risks like that.

Developing and maintaining online reputations is difficult within grinding, since there is a tension between its ideology and practise. There is an ethos of sharing information and technology, a desired autonomy to modify the body, and an emphasis on avoiding politics to get things done. At the same time, there are many risks grinders are forced to consider: components can have unknown quality, and other people may misuse their ideas, products, and information, which could lead to someone's injury or legal repercussions. There are no guarantees, and it is nearly impossible to sort out the woo from the wu over the internet. Those with the luxury of meeting in person likely find it easier to ascertain a level of trust -- I certainly did. But the freedoms afforded by the internet quickly become responsibilities, and once information is online it is out of grinders' hands. As a result, a lot of things discussed in person are never posted online (elaborated on in section three below), partially out of fear that such information might hurt others and, in turn, themselves.

2. Regulations

Because grinders are conscientious of their tentative co-implication, most have mixed feelings about potential regulations: whether self-regulation is enough, whether it is even possible, and what possibilities exist for 'more official' external regulations beyond what already exists (e.g. minimum orders, credentials, zoning laws). Of course, some grinders clearly don't care if there are regulations and will continue to flout existing laws. Others, like Matt, consider whether a higher level of governance might "protect us from ourselves, I mean, our own stupidity. We're going to get eager and do something stupid."

On the one hand, some grinders noted if there were government-level regulation it might be easier to access medical professionals for opinions and procedures. This would eliminate the need for contacting companies under false pretenses, which would in turn make it easier to have third party assessments (e.g. cytotoxicity testing, quality control) of implantable devices. Combined, these changes could make the general public's perceptions more accepting of body modification and enhancement, thus advancing grinding as a movement.

But on the other hand, most grinders feel that regulations are not yet necessary because they likely lead to suppressive professionalization. Their legal situation is already murky at best, with potentially applicable body modification laws varying by state or even county. American grinders are particularly wary of the Food and Drug Administration (FDA) and the possible interpretation of augmenting-implantables being labelled as medical devices. The FDA defines a medical device as "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory which is:

- recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,
- intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or
- intended to affect the structure or any function of the body of man or other animals, and which does not achieve any of its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes."

(https://www.fda.gov/AboutFDA/Transparency/Basics/ucm211822.htm)

The second and third bulleted points are most relevant, since body enhancements could fall under such parameters. Some grinders – notably those who are selling products – are adamant that their implants ought not be considered medical devices. But language of "diagnosis of … other conditions" and "intended to affect the structure or any function" provides leeway for future juridical argument. If such a decision were ever made, it would certainly create a barrier to anyone wanting to sell implants. As a 'medical device,' piercers or body modification artists would even be prohibited from injecting RFID tags.

The question of regulation thus becomes largely a question of visibility. To my knowledge, the status of grinders' implants has not yet been legally challenged, and this seems unlikely to happen soon without a high-profile example (though I am admittedly not confident in making such predictions)[17]. Certainly, there are no laws that specifically address grinding. Yet as critical legal studies have shown, even if grinders' implants are *technically* not medical devices today, the *operation* of law is historically contingent upon social constructs, where legal (re)interpretations act as "attempt[s] to create coherence out of the competing and contradictory social influences and arguments which animate them" (Nelken 1987, p. 110; see also Hunt 1993, 1997; Unger 1983). In other words, just because grinders' implants haven't been defined as medical devices *now* doesn't mean the political intention will never arise to re-interpret existing laws. This means new laws may not even be necessary, a possibility that underlines the need to self-regulate and avoid making visible anything that might direct government attention towards grinders. There is an awareness amongst grinders that some projects benefit from being "not all public," says one anonymous grinder, since "I would be more worried about legal trouble; I would be worried about media attention that we don't get to control the way we want."

Unfortunately, provocations of governmental authorities are out of anyone's control, as evidenced by the occasional provocative post on biohack.me. Will recounted his apprehension about how biohack.me can attract dangerous ideas. "I think a while back somebody came talking about an implantable bomb. That sketched me out so much. And I don't even want to think about how that's going to go down whenever we first have a conflict with one of those

[17] As a recent example from the parallel body modification scene, Ontario has proposed laws to ban eye tattooing and jewellery after a botched procedure resulted in significant media exposure ("Ontario moves to ban…" 2017).

…[or] somebody comes out with […] an implanted knife." Zac echoed this concern, opining on how grinding only works now because it is a small enough movement where people are reasonably informed on why and how devices should be implanted.

> I think it's relatively harmless, but it's definitely a pretty recent phenomenon, I think. But it's probably only going to become bigger once more people become aware of this movement. I fear that the more of that sort of attention that it garners the more that someone will die at some point from some mishap of a procedure, and then something's going to happen. I don't know what, but once one person dies, then they're going to get a lot more attention from the wrong kind of ... [trails off]

In response to worries about become legally regulated, grinders come to operate "in the shadow of the law" to avoid the uncertainty of being subsumed by legal interventions (Mnookin & Kornhauser 1979, p. 968). Laws that exist or even *could* exist affect who tells whom what in hopes of avoiding the situation altogether. With the exception of the odd outsider posting something salacious on biohack.me, anything that might bring the law into is not posted online. Though my interviewees occasionally dropped hints of someone having been seriously hurt, such stories were downplayed, glossed over, or intentionally low on details. (I also have to consider that these stories, vague as they were, may be played up. After all, though he never hinted of anyone getting hurt, John admitted to me that its ambiguously illicit nature is part of what makes grinding appealing.) Some of my interviewees prefer to work anonymously, and would only talk to me after receiving such assurances – not just by using pseudonyms, but even encrypting all correspondence. Maintaining anonymity of authorship hides mistakes and prevents repercussions and prosecution (see Hasler, Ruthven & Buchanan 2013; Terrall 2003, pp. 103-108), but it also makes reputations and peer recognition difficult if not impossible to determine (see Jordan 2008, pp. 29-30). Of course, those who wish to remain anonymous may also become outed if not careful (see Coleman 2014).

For now, it seems avoiding or forestalling formal regulation amidst the mishmash of (non)anonymity is the predominant position taken by grinders, and this is achieved largely through a plethora of informal regulatory processes that shift responsibility from groups to individuals. As Amanda sums up,

> The whole point is sort of the DIY and you're doing this mostly on yourself, occasionally helping each other out, but there's definitely a strong component of my body, my sovereignty of myself, and I'm doing something that I feel is important for various reasons for myself. And that privacy, that sense of personal sovereignty and privacy I think is something that shouldn't be violated by various regulations. […] And if it goes wrong, I expect there'll be a period where there'll be overregulation, saying 'oh, you can't do this and you can't do that.' And the community will collectively flip the bird at them and then go off and do other things because that's kind of what they're already doing. So it's going to be very interesting to see how they try to interact and what accords they come to.

Three other interviewees independently and specifically evoked the metaphor of needing to break a few eggs to make an omelet, further emphasizing the individual risks required for the sake of the community's integrity. "You're expected to do the footwork," says Evan, because "at this point it's a little more shaky." This strategy assumes that someone is going to get hurt, but that the scene itself can be protected by responsibilizing the experimenter.

There are two main strategies for socially enforcing self-regulation. The first is a 'neither encourage nor discourage' tactic towards those who want to perform modifications on themselves:

> What tends to happen, from what I've seen, sort of that common sense middle ground of, here's what I tried. It worked for me. Your mileage may vary. Here's what worked for me and it did not work for my friend, or, you know, oh, I tried this, spectacular fail – don't do it. Please don't use Sugru. Please. (Amanda)

A second tactic is to ensure consent to assume future risks:

> Now if you're going to sell somebody a device to put in their body, I don't have a problem with that either, as long as you have full disclosures out there, right? That if you put this in your body it's going to have to come out at some point. It could be 20

> years from now, it could be a month from now. It could blow up and you will die or it could leak and you'll die. It could do any manner of things and you will die […] but, it could be amazing if you do it. You know, I think if there's enough disclaimers and people want to take their lives into their own hands like we do, then good for 'em. (Rich)

There is thus a recognition that the integrity of the community rests on the free flow of information and an open dialogue, but while the community takes credit for ideas and freeing information, it does not accept any responsibility for putting those ideas into practise. Thus, group collaborations quickly become individual culpabilities, as the online grinder scene distinguishes itself from the singular grinder practitioner.

3. (Anti)collaborations

Currently, there are only a handful of 'grinder' products sold commercially. Selling does not necessarily mean abandoning the sharing of information or a commitment to open source, but it does complicate things. This complication is illustrated by Grindhouse, who are committed to open source but at the same time seem to be learning how difficult it is to deliver. On the one hand, Grindhouse members want people to be in control of anything that is inside their body, as well as have the freedom to manipulate it or 'hack' it to their preferences. They see this as a way of building a market for augmenting the body. As Jes puts it, open sourcing is important because "I want people to build cooler things than we're building right now […] and if I can help them get there then maybe I can catch after them, we can play leapfrog for a little while. But if we keep the technology from being able to progress, technology's not going to progress." By allowing competitors make, improve, and customize similar products, customers can have greater confidence in the future possibilities of choosing what they want (Weber 2004). Yet, as Marlo points out, Grindhouse is not yet in a position to do this, admitting that

> …if we give away all our schematics before we actually sell our product, people will just rip us off. I'm thinking when we get to the next product we'll open the source to the previous one. So right now we're on version one of Northstar. We're working on version two. When we start selling version twos, the source of version one will be

> opened. We'll give our designs out, we'll talk people through our production process, say this is how we do it, these are the companies we used, here's our schematics and our blueprints and all this shit. Build your own, change them, do whatever you want, hack people's, we don't give a shit. (Marlo)

Once again, we see an example of having one foot in the present, where money is needed to move forwards, and one in the future, when the question of technology being universally available (i.e. unbound by economics) will have been pre-empted by the mutual sharing of knowledge and expertise. Long (1991) observes that an inventor can protect their intellectual property interests by either pursuing a limited monopoly via a patent, or they can intentionally conceal their knowledge as a 'craft secret.' Given how grinders generally feel about the effectiveness of patents (i.e. they are ripe for piracy), it is not surprising that Marlo has at least temporarily opted for the latter. Taken together with Justin's concerns about the average person implanting a Northstar, we can understand why Grindhouse feels the need to maintain a certain 'intangible property' of their products by maintaining craft secrets. The results of this approach, according to Long (1991), include enhancing the status of the practitioners, enhancing the 'insider status' and cohesiveness of the knowledgeable group, and, perhaps most importantly for Grindhouse, it prevents the devices from being used without the author's consent.

Because grinders' projects are intended to become a part of the body, the question of authorship is of paramount importance to them. A frequently cited phrase in the grinder scene is 'My body, my rules.' However, questions of authorship complicate this motto by inevitably creating a tension surrounding who is responsible: the person inventing the device or the person implanting the device? The concepts of authorship and property rely on a Western notion of personhood (Biagioli & Galison 2003; Foucault 1998), and since grinders seek a radical rethinking of the latter there is a presumption the former would be significantly changed. The most obvious example is altering DNA. Biohacker Josiah Zayner now sells *The Odin*, a home genetic engineering kit that grinders have begun experimenting with on themselves. There is extensive literature on the breakdown of the human category vis-à-vis disputes over property and authorship surrounding the modification of 'natural' genomics (e.g. Dickenson 2007, ch. 7; Fox Keller 2000; Lock 2007; Reardon 2005; Thacker 2006). These breakdowns often centre around disputes about how part of one's body (e.g. DNA) can be the property or responsibility of

someone else. If the concept of *personhood* is changed, then so, too, will the concept of *property*. As exhibited in the aforementioned literature, genetic modification and other grinder modifications may open up the body to becoming patented and intruded upon by emerging forms of property and authorship. Grinders, however, interpret this dialectic between personhood and property as being able to modify implanted devices making them authors of both those devices and, more importantly, themselves. Modifying their DNA or adding electronics challenges the 'naturalness' of what it means to have a body, or be human or an author, and therefore the concept of property breaks down to the point where open source is grinders' minimum viable solution. But is it possible for modified bodies to be open source and therefore avoid juridical intrusion on the body?

Critiques of open source software have much to teach us about such possibilities and grinding as 'open source wetware.' To begin, open source does not mean free as in no-cost (*gratis*), but rather free as in allowed to interfere (*libre*) in the *process* of creation (Weber 2004, p. 56). Rather than sales, open source software efforts tend to cover production costs through commercial licensing, providing services (e.g. troubleshooting, repairs, certifications), and/or offering paid upgrades (Krishnamurthy 2005; Weber 2004). For wetware, these avenues would include assembly/manufacturing, installations, and removals – procedures that capitalizing grinders already tend to avoid monetizing for liability purposes. In other words, even if grinders had money, it would not preclude legal issues since most activities that encompass grinding are already legally defined. Procedurally, then, grinding is both economically and legally disadvantaged, as open source wetware conflicts with operating in the shadow of the law.

Compounding this disadvantage, open source assumes the resources (both material and expertise) required for production are plentiful (Jordan 2008; Weber 2004). In other words, there needs to be enough *capable* people working on the project for it to succeed. However, the bodies of willingly experimental grinders are decidedly limited in this respect. In fact, Grindhouse and a few other grinders have attempted to make up for this deficiency by forging partnerships with body modification artists to participate in the development and implantation processes. The difficulty that arises with such partnerships is the body modification scene is the polar opposite of open source in that the services they provide are obscured in trade secrets to preserve their reputation and marketability in an already niche market. As it was explained to me by several grinders, once a body mod artist has gained a reputation for a particular procedure

they will then teach (expensive) workshops to other artists, after which the participants can claim they were 'taught by' that expert, and only use (expensive) products/tools built by that expert. As a result, the body modification industry is based on competition, not collaboration.

Attempts at collaborating with body modification artists have had mixed success for grinders. Beyond their overriding concern of maintaining reputation, body mod artists' expertise focuses mainly on aesthetic and not augmenting ends. The two do not always overlap. Grindhouse originally partnered with Steve Haworth, who has extensive experience with coating magnets and creating other silicone implants. When it came time to coat their Northstar, however, after a year of waiting the prototype came back with a coating far too thick for the device's application (Marlo).

Making the shift from hobby to business has led Grindhouse to also develop other necessary partnerships to ensure consistency and quality in the manufacturing process. With their Northstar implant, the cost of having small runs of circuit boards done by a third party is more affordable than making them in-house. Cytotoxicity testing is also done by a third party to ensure independent safety standards. Finding a company that could provide a bioproof coating adequate for humans was more complicated that doing it in-house, but the results are more consistent. These relationships are all necessary to achieve a "reproducible quality" (Marlo) product that is not only safe but easy enough to implant. Even though Marlo is determined to help people make and hack Grindhouse's devices, reliance on outside parties shifts this possibility away from open-source towards reliance on expertise.

For Amal of Dangerous Things, third parties are unavoidable when dealing with electronics, and especially anything involving batteries. In fact, he currently refuses to make any implantable devices with batteries. "A pacemaker can use a lithium battery, but every resister, every capacitor, every component in there, the PCB, everything was quality checked and high tolerance, tight tolerances, from the ore that's mined from the ground all the way to going into the chest. That's why it's 30 grand, right? There's no way that you can provide that level of quality assurance." He cites the recent example of exploding batteries in Samsung phones. "Your circuit design can be perfect, your components, everything can be great. You can test the batteries all day long. But one component goes out of spec after three weeks of use or a year? Something happens where the quality of a component is causing a failure, a failure you couldn't have anticipated or tested for."

Though he was a big part of the early grinder scene, Amal has moved away from open source as a possibility for body augmentation products. He now labels himself a "bionics hacker" to distance his company from evoking the dirty, underground, grunge, cyberpunk image of 'grinder.' (Moreover, to the general population the term is already associated with the homophonously titled geosocial networking app, *Grindr*). From a branding perspective, these are impediments for a legitimate business.

It isn't just the name that Amal is trying to separate from; he has also distanced himself from the grinder ethos. When the biohacking scene started it was full of like-minded individuals who were intent on sharing information, both out of an interest in progress but also to mitigate experimental risks. Amal explains how this changed for him over time:

> And then there's R&D costs. There's real, actual investment going into this, personal time, money. The second you decide to do that it creates financial tension. Then when you decide to recover that effort and sell, now there's a commercial tension between people that want to work on similar projects, or the same project, right? Direct competition. And so there's a lot of things that start out very kind of in the spirit of the community, and then it ends up becoming very disingenuous very quickly. Information and goodwill that was shared earlier now becomes liability, right? And it's sad and it's frustrating. I would much rather see somebody collaborate with somebody on the board or whatever, and see them make something I'm not making […]. But in a lot of cases, twice now, I've talked to people and given them information or whatever, encouragement, or introduced them to vendors or whatever, and the first thing they do is compete with me directly on exactly the same product.
>
> […] It's made me pull back from the board. […] I'm not participating anymore, and that sucks because that's where you try to look at it like, well, we're cool because we're bringing this stuff to the market and Google's not going to do that, Samsung's not going to do that. They're too scared, too big, and they don't really care about our little community, right? But now I'm in the same position, not wanting to engage with the community because the benefit for me is like I always get kicked in the teeth.

Amal's first foray into RFIDs predates 2005, though he only began pursuing it as a business in

2013. He didn't specifically mention to me who those competitors were, but I am aware that in 2014 at least two other grinder-scenesters began selling similar RFID products at slightly lower prices, and since then a number of body-modification artists have also started selling RFID products.

That personal reward breeds competition, and therefore secret keeping, is not surprising. It is a well-documented phenomenon even in scientific practices (Evans 2010; Knorr-Cetina 1999; Merton 1957; Shapin 1994). What is interesting, however, is the ripple effects for both the broader on- and off-line grinder scene caused by this tension between sharing information, making money, and controlling the flow of information. Offline, beyond splitting the revenue pool and constraining funding for other projects, this tension also puts less commercially focused grinders in uncomfortable positions. Jeff in particular feels these effects. As one of the designers of the M31 magnets originally sold by Dangerous Things, he has amassed knowledge and expertise that other grinders frequently call upon for him to share.

> If [another grinder] is working on magnets it's like how much information can I really give him without feeling like I'm screwing Amal over, you know? On one hand it's like I want him [the other grinder] to be able to make a safe product. I don't want him to spend a shitload of money making something that's going to be shit. I'd like to help him but, flip side, it's like – I don't know. So to me, I draw the line on, well, I'm not going to tell you what vendors I used. I'm not going to tell you certain little key things, but the general of, like, hey, if you want to test it I think that's great information. Like, this would be good so you can test it and see how well your shit worked, you know? Because otherwise if you're doing inadequate tests, then that sucks. (Jeff)

Once products are being sold, it stymies the flow of information from distributors and affects those on the periphery who are not even seeking personal gain. Partners either become circumspect about collaborating, or even become competitors. This means withholding information from others, or at least offloading production onto third parties who have no obligation or even inclination to share their expertise.

Multi-mediations

When information flows between on- and off-line, freedoms become risks, responsibilities of groups are shifted to individuals, and partners become competitors. These do not always happen, but they could happen at any time, and even all at the same time. I often found myself in a similar situation to Jeff, as my research made me aware of types of information that I didn't realize were 'secretive' until I began conducting interviews outside of the California or Pittsburgh areas. After the formal interview had finished and the recorder was turned off, the roles reversed and I would be examined about all things grinder. The questions commonly began by probing life beyond the biohack.me board, such as what other people's workspaces were like, if there were any unannounced projects being developed, or what certain posters were like in person. Occasionally, people would ask me about how products compared, and what others' experiences have been for different brands of RFIDs or magnets.

Though only a few of them explicitly mentioned it, I think many of these questions were prompted by a biohack.me thread that had been posted a month or two previous to the interviews. The thread was started by Amal, and reads as follows:

> Someone from this board contacted me and wanted to discuss a flexible NFC tag they received as part of a beta test from Alex / cyberise.me – it surprised me to learn there was a flex tag coming out from cyberise, so I engaged in a lively discussion. Ultimately, this person wanted to trade the flex tag they received for a [Dangerous Things] flexNT. I agreed, if only for curiosity's sake. I received that flexible tag and it sat on my desk for weeks… but yesterday I finally opened it up and found, to my horror, a device that was nothing close to what I'd consider to be safe for implantation. The beta test tag Cyberise sent to this person, with the understanding that it be implanted as part of the test, was really badly constructed. The silicone used to coat the tag with was mixed very badly, with air bubbles trapped throughout the silicone coating which probably contain evaporated curing agent and/or solvent vapors. It also had fibers and hairs embedded throughout the coating, and dirt and other refuse stuck to the surface of the coating. But the worst thing was that the tag was tacky when I attempted to take it out of the pouch. I moved the tag off the paper pouch and it left a mark on the paper… that means the silicone elastomer was not fully cured and still had plenty of unlinked polymer… this would have been disastrous to implant.

At biohack.me this post only attracted a handful of responses. Among them, Alex posted a response admitting the device wasn't fit for implant and figured it was sent out by mistake, and the discussion essentially ended. However, many of my in-person interviewees were interested if I knew anything more going on behind the scenes, which products were of good quality, and who could be trusted. Their questions reflected the collisions between all of the aforementioned tensions of the seen and unseen: the need to avoid negative publicity and maintain reputation, the need to share information but not give too much away, the need to make money to afford developing quality products, the need to make products cheap enough to be widely affordable, the need to maintain the cutting edge while being safe, the ability to make the product you want but not out of the materials you want, and, above all, the need to ask someone (in this case, myself) questions in person to avoid visibility.

Open sourced or closed supports

Things have come a long way since the early days of Lepht's blog. At first it seemed as though the entirely self-directed projects of grinders would culminate in affordable biohacks where they are free to choose which projects they pursue and how they are built. Now, the grinder scene is caught up in neoliberal self-governance, wherein the expectation is everyone will take responsibility to educate themselves of the risks. Neoliberalism assumes market forces are the best way of finding out what 'works' (Mirowski 2013), but the problem for grinders is the culture surrounding biohack.me prevents its users from being able to fully and properly educate themselves. They don't know what they don't know.

Furthermore, the process of open-source science becomes problematic when it is co-opted by private interests. What happens (and doesn't happen) on biohack.me is only a microcosm of broader economic processes. While open-source science seems like a transparent and laudable endeavour, as Philip Mirowski (2013) explains, in practice it often ends up being little more than a neoliberal shifting of risk from corporate interests onto non-waged labour. The biggest supporters of open-source science are venture capitalists and corporations (e.g. Microsoft), who sit back and wait for small, independent efforts to do all the legwork, make mistakes, and produce information, so that they can buy up whatever has value as a commodity without research and development expenses (Mirowski 2013; Terranova 2000; Tyfield 2013).

Grinders – and especially the grinders who do not make products but instead volunteer their bodies to test prototypes – are necessary for this expansion of capitalization, but they will quickly become superfluous to the production process, like a human who builds a robot that takes their job (see Dyer-Witherford 2015).

In a way, grinders are already doing this to each other when they move production off of biohack.me to other digital platforms and real life, as internet posters on biohack.me (who are still somewhat committed to its original ethos of sharing) continuously produce free cultural and immaterial labour for grinders on the outernet (Terranova 2000, pp. 34, 41). Just as grinders criticized academic scientific journals for not being descriptive enough to facilitate reproducibility (see ch. 3), grinders' productions can be just as concealed. There is therefore an instable semi-stratification of social and cultural knowledge within the grinder digital economy, with biohack.me near the bottom, and the various semi-private/private partnerships (e.g. on Slack, at Grindhouse, in-person meet-ups) acting like gated communities (see Terranova 2000).

Who profits from this arrangement? As it turns out, many people do, but rarely are those people grinders. The most useful project information on biohack.me – including information provided by those with a more revolutionary hacker ethos – ends up being channelled to other partnerships for potential commercialization. Meanwhile the information *about* these projects is spread across the internet and monetized by non-grinders. "Free labour," writes Terranova (2004), "is the moment where this knowledgeable consumption of culture is translated into excess productive activities that are pleasurably embraced and at the same time often shamelessly exploited" (p. 78). Projects posted online are published by Amazon, socially mapped by Facebook, and data-mined by Google (Tyfield 2013), not to mention the 'journalists' who sensationalize grinders' efforts to maximize ad revenue. More directly, entities like circuit manufactures, biocoating companies, and the body modification industry also make money off grinders' labour. In doing so, grinders have made themselves *customers in the market they seek to invent*. There's no question grinding has become something different since Lepht began self-implanting magnets because body mod artists were charging too much at 40 to 50£. A few years later, Dangerous Things was selling the grinder-designed M31 magnet for $60 USD.

The irony is that as much as some grinders want to undermine the private/institutional/corporate power, they rely on it. After all, even piracy requires capitalists to produce something to pirate. As Terranova (2000) explains, even if free digital labour (e.g.

producing content on the internet) is not directly produced by the economic needs of capitalism, it nonetheless comes to play a part in the "process of economic experimentation with the creation of monetary value out of knowledge/culture/affect" (p. 38). The neoliberal politics created by the flow of information between on- and off-line reinforce the systems of exploitation that grinders had hoped to counteract with cooperation and sharing information. In some cases, grinders are even supporting exploitative consumerism with actions like purchasing Chinese knock-offs, thus leveraging developing countries by outsourcing the extraction of materials, assembly, and sale (Dyer-Witheford 2015, pp. 104-109; Qiu 2009). For grinders, sharing happens only when it is in their self-interests, regardless of whether they are the exploiters or exploited.

To be fair, I don't think many grinders care. For the most part they are happy about the success of their peers, that new products are being created, and that implantable magnets are available. Even without the skills necessary to take advantage of open-source technology, as Matusow (2005) points out, "to most people having the *option* of doing something is of far greater importance than actually doing it" (p. 330; see also Jordan 2008, ch. 5). In grinding, decisions about what to share are qualified by the sharer's self-interests as mediated in large part by the internet. According to Massumi (2015b), within neoliberalism an individual's success is measured "in the currency of satisfaction," and therefore rationality and affect are inseparable (p. 5). By this metric, despite conflicting practices and ideologies concerning how to go about grinding (sharing, making, selling, regulating, etc.), everyone wins to some degree: ideas of many are freely turned into products by a few, which can either be bought by consumers or stolen by pirates to create new ideas, and repeat. This continuous cycle of cooperative exploitation is a reason I think many grinders would cite as an example of why grinding is necessary: to seize their senses from the clutch of capital. In the words of Jacob, "there will always be those Lephts." And Lephts, I suggest, will always pave the way for emerging markets, and so on.

Conclusion

Today, there are only handful of active posters left from the original formation of biohack.me, and the board's founders have long abandoned it. When I asked what had changed about biohack.me over the years, the answers consistently described how a site of imagination

and collaboration had become stale, with the same questions being repeated ad nauseum, and few new projects proposed. Yet, offline, progress continues. Posters who had once been very active expressed a continued interest in the board, but to a much reduced degree. Ron described how the board has shifted from "'everything's new and exciting and a field to make progress in,' to 'oh, no, this is the magnet, go get this magnet, don't look at other magnets.'" Hundreds of miles away, Brian repeated almost exactly how "It's become a little bit more rigid. People are less, like, 'oh, let's try this new thing,' to 'we've got procedures and standards, follow them.'"

Jeff, who is still somewhat active on the board, further elaborates on the effects of these changes. "It's a lot less collaborative and more competitive," he tells me, which has made him pull back. "I'm busy, and I already interact with the people that I care about interacting with for the most part. So rather than having, like, 'hey, look, there's these guys on here that are really good at this thing and they have this knowledge,' it's kind of like, ah, I already know a lot of the people in the community and if I wanted to hit up Rich on something or Ben or whatever I just hit them up directly."

Members of Grindhouse Wetware told me they still check the board, but it is no longer their primary source of grinder news. Ian told me he rarely posts anymore. "I'm still following the boards for the most part, but I've basically been focusing on Grindhouse Wetware stuff. I think the last topic I was really active on [at biohack.me] was back when we were discussing the possibility of replicating Kevin Warwick's project cyborg. That was the last major thing I was involved with, and now that's another Grindhouse project anyway." Marlo is also put off by the boards increasing level of "idle speculation," adding,

> The community is full of wonderful, intelligent people. The thing they all suffer from is that none of them particularly want to collaborate. It's why Grindhouse, we all just -- okay, how can we pool our skills together to become more than just the individual? I feel like everyone on biohack.me wants to be kind of special. They want to be the individual who came up with this supercool thing. But there's so much work to be done that it'll take them too long that way. So nothing really seems to come out of biohack.me, and the things that do come out of it aren't done to any particular level of quality.

Online, production of grinder projects has slowed almost to a halt. Offline, however, production continues. I have described only a small portion of the grinder network formed by/through the internet. These are but a few examples of how the internet brings grinders together, yet also organizes offline production. Even if none of this is concerning to grinders at present, I think they should at least be concerned by the tendency of corporeal enhancements facilitating the expansion of capital into bodies and into the senses. Grinders' senses *will be* subsumed by capital, despite – and even because of – efforts by pirates or open-source policies.

Chapter Five
Killing Love:
Modifying the Depth of Senses

It is August 5th, 2016, and I am standing on my head in a Las Vegas hotel room. From this position not everything is inverted, since dozen other people are also struggling to keep their nostrils pointing upwards, with varying success. Maintaining a liquid in the nasal passage doesn't come naturally, but it only needs to be sustained about five to ten minutes for sufficient absorption across the blood brain barrier. Why? A couple participants probably don't fully know, having only just shown up and decided to join in on a whim. For myself, I can trace the event's origins back at least a year and a half to Grindfest Zero, where I and a handful of grinders sat around a fire discussing the sorts of things that staring at flames after nightfall tends to evoke.

It began as a joke (as so many grinds do) that unfolded in a collaborative reimagining of the tenuous grasp of bodies on reality as forged in shared, verifiable accounts. The conversation's catalyst was the CIA's MK-Ultra, something of which the present grinders each seemed to have some working knowledge. I, too, had some small factoids to contribute, since I'd heard one of the major sites of the experiments was McGill University in Montréal, just down the street from my apartment. The controversial and illegal program used non-consenting patients to research mind control via sensory deprivation, administering LSD, and electroshock therapy (see The Fifth Estate 1980; Vanderperre ND). The conversation soon drifted into examples of mass hysteria, such as the West Virginian folklore of the Mothman. As retold at Grindfest, the Mothman is a large, owl-like creature that multiple West Virginians claimed to see over several years in the 1960s, possibly due to lead poisoning in the water supply causing group hallucinations. The grinders weren't proposing to replicate these phenomena, although someone suggested the next Grindfest would be livelier if Tehachapi's water supply was dosed with psychedelics to improve the town's morale. We all laughed at how bad an idea it was, but as the fire wound down so did the conversation.

Fast-forward to the early summer of 2016, in the dining room of Tehachapi's sole Taco Bell. Jeff and I were, like usual, brainstorming ideas for Grindfest Three's enhanced paintball battle and the traps he can set up. Thinking back to the conversations clustered around MK-Ultra and the Mothman, I jokingly recalled the possibility of benevolent drug dispersion. Jeff

responded by recounting a story about the U.S. Airforce experimenting with a 'gay bomb' to to administer aphrodisiac chemicals or pheromones to confuse the enemy by making them attracted to each other. It didn't work. But then the idea hits him: "Oxytocin."

Other grinders soon heard about this idea, consulted the academic literature, and now here we are in a Vegas hotel room, a full eight months ahead of Grindfest 3, upside down, intranasally ingesting oxytocin. Oxytocin is a neuro-peptide pheromone produced naturally by the body that is associated with pair bonding after sex or between a mother and her newly born baby. Biomedical research indicates that dosing oxytocin improves the ability for humans to infer mental cues (or "mind-reading," in the words of Domes et al 2007), and plays a role in the regulation of fear response (Kirsh et al 2005). And since we are in Las Vegas, I find it particularly relevant to also quote the introductory paragraph of a paper by Kosfeld et al (2005), titled *Oxytocin Increases Trust in Humans*:

> Trust pervades human societies. Trust is indispensable in friendship, love, families, and organizations, and plays a key role in economic exchange and politics. In the absence of trust among trading partners, market transactions break down. In the absence of trust in a country's institutions and leaders, political legitimacy breaks down. (p. 673)

Despite Kosfeld et al's assertion that oxytocin increases trust, it is not exactly clear *how* this happens. Is it about olfactory responses, visual cues, or something else? Once our ten-minute absorption period elapses, we test our hypothesis by playing poker on an overturned mattress, with half-baked intentions of taking our plan downstairs to the casino if we can read minds or somehow make a card dealer over-trust us.

Ultimately, the results were inconclusive (to be generous), likely affected by a number of non-controllable variables such as poker ability, the unfamiliarity between certain group members, plus who knows how many other confounding factors. Some people felt vaguely positive effects, some felt like they had diminished math skills, and others, including myself, felt no change at all. Despite perhaps disappointing results, what struck me as important about this experiment was how grinders had conceived of modifying their senses in relation to specific social activities. The so-called 'mind-reading' and trust bonds implicated not just biological

facilities, but also economic exchange, interpersonal relationships, and beyond. There was an appreciation that societal context is an integral part of sensing, sensibility, and the modification thereof.

And while the oxytocin experiment was all in good fun, it also raised the possibility of a far more disturbing biohack. If, as the biomedical research suggests, oxytocin positively affects social bonds, then to what degree is the opposite also possible? While reviewing the oxytocin literature with Jeff at the Tehachapi lab, we ran across an antagonist that appeared to do just that. I unaffectionately gave it the codename *Project Solipsist*, though it is more properly known as MK-801 or dizocilpine. This substance blocks glutamine, one of the brain's primary excitatory neurotransmitters. Unlike research on oxytocin, there is understandably little in the way of human trials for MK-801. However, animal trials tell the story well enough. For example, Deiana et al (2015) showed MK-801 reduces social recognition memory in rats, though it did not reduce sociability. Morales and Spear (2014), however, found it reduces the social activity of rats at certain doses. Zimmerman et al (2016) were able to induce social interaction deficits in zebrafish. One of only a few Erowid entries claimed dizocilpine resulted in "the most beautiful lobotomy I ever had" (viscosity 2013). In short, MK-801 appears to make animals less interested in being with each other[18].

To be clear, the ingestion of MK-801 by humans seemed like a bad idea to grinders. But bad ideas are also sometimes the most interesting, even if only as philosophical fodder for thinking through the relationship between bodies and society. Given historical events like MK-Ultra, from a grinder perspective, it is just as important to understand the ramifications of bad ideas as it is to pursue good ones.

The day after Jeff and I started reading the literature on MK-801, Rich visited the lab and speculated on the possibility of dizocilpine being a break-up drug for helping the heartbroken get over the painfulness of unrequited feelings. He joked about one of his long-held plans to "kill love"[19] by countering the perceived negative aspects of emotion. In a later interview, Rich

[18]Much of the research on dizocilpine examines the biological mechanisms of autism and schizophrenia.

[19] At least I think he was joking, given that he also briefly sang an eighties-style song about killing love while making this assertion.

balanced this account by highlighting his concerns about human isolation and the tenuousness of society's moral fabric:

> And so with the solipsist thing, that was something that totally intrigued me because being able to pull off the opposite [of oxytocin…] and make something that's completely awful, just dis-bond somebody […], just shows you the fragility of it and how a lot of our society is based on these family bonds and friendship bonds and things like that.

Rich further recounted a story he heard from a criminal lawyer who had defended a man charged with the sexual assault of a random victim. They argued a change in medication had transformed him from a "normal" person who had "never been in trouble in his life" into something "like an animal." "That's his alibi, anyway," Rich added, emphasizing his inability to know for sure and the insensibility within the question itself.

Even though oxytocin experiment didn't exactly work as hoped, and no one has tried MK-801, these substances represent the implications of modifying bodies and senses not just for grinders but also more generally. First, they epitomize the high stakes of what grinders expect is achievable: the re-arrangement (and possible destruction) of taken-for-granted social bonds. Senses and society are co-implicated, and though social problems probably cannot be reduced to senses alone (e.g. economic exchange cannot be reduced to oxytocin), at the very least senses play an important role in how socio-material assemblages are understood. Grinders are not just modifying their senses, they are also modifying their *sensibility*, that is, not just *how* they sense but *what* they sense, and so we need to account for both. Second, they expose the difficulties of researching modified senses. How are we to research, or even talk about senses that might be erased or modulated and vary by both person and time?

The purpose of this chapter is to draw from the examples of the oxytocin and MK-801 experiments to tease out dimensions of sensory assemblages. By 'assemblage,' I mean a networked collection of entities that act together within a larger network. Identifying these sensory assemblages will not only illuminate the outcomes of grinding as a broader project, it will also help to develop an analytical toolbox for the case studies of the proceeding chapters.

Sensible society

To this point, ANT has served us well for tracing the networks that flatten institutions and global crises to the imminent actor-networks of grinders. It has described the informational flows and mediations circulating on- and off-line. By applying ANT, I have watched with my eyes what grinders did, and traced networks through what grinders said. But how can it account for senses themselves, which are sometimes invisible and unspoken? What happens, as we will see in the next chapter, when some people can sense electromagnetic fields and others cannot? Things that sometimes involve, for me, unknown unknowns, but are known knowns for them. The most obvious solution was to participate myself in grinders' sensory explorations as much as possible. But such an approach is not always available. What does ANT have to offer for inquiry into senses and sensory modification?

Recall from Chapter 1 that one of the prime advantages of ANT is its commitment to ontological hybridity. As explained by Latour (1993b), this position argues nature and culture are coproduced, and their apparent distinction is only an illusion produced by the attempt to master 'nature.' What is known about nature is contingent on technology (no matter how primitive or advanced), technology emerges from the so-called natural, and the social dance between them is an ongoing process of inseparable mediations (Misa 1992). Thus, how oxytocin 'works' is inseparable from what happens when oxytocin goes in a grinders' nose, regardless of whether the results are biochemically caused by oxytocin itself. The oxytocin makes other actions possible.

Further recall that the finer points of any given nature/culture hybrid depend on the actants that define them, with an actant being anything (whether object or network of objects) that has the relational capacity to act. That something like MK-801 could potentially erase certain sensibilities identifies an actant whose traces were previously invisible. Grinders become what Latour (2005) calls a "spokesperson" (p. 31) for MK-801 as an actant within an assemblage of grinder biopolitics. This historically invisible actant seemed stable enough, and so it and the networks that depend on it were invisible (an unknown unknown) until it was made to act. From this perspective, the social would not be erased by MK-801, but rather reconfigured. In this way, attempting to render something insensible to the body is to attempt detaching an actant from its network, and, likewise, finding new sensibilities involves activating new connections through which new networks can be enacted. Most importantly, if a grinder identifies an actant that they

hope will act in a particular way, even if it does not meet their goals it nonetheless acts in a plethora of other ways. Grinders' enaction of MK-801 is an act of "purification" that tries to 'wash out' the irrational (Mol 2002, p. 160), even though this process relies on and enacts other hybrid actants (Latour 1993b, pp. 40-41). For another example, the oxytocin was largely ineffective for altering economic ties, but it nonetheless brought a dozen people together in a hotel room, it flipped over a mattress for a poker game, it prompted further research ideas, and it enacted other corporeal hybrids (e.g. 'drunk on oxytocin').

What does it mean for grinders to try and alter what is sensible about society? In oxytocin and MK-801, grinders would have public and private rebalanced, such as who they feel close to or not, and which social processes are shared or one-sided. As grinders contemplate modifying sensory assemblages by extending networks outwards from the body, what other enactments are implicated? (To be clear, when I say extend 'outwards' from the body I mean in an analytical direction, as the body is the point where grinders' questions and modifications begin.)

Arising out of these questions are two main challenges for trying to trace enactments of sensory modification. They are not entirely unique to the object of senses, though there are peculiarities that arise from such an inquiry. First, the main difficulty in researching sensory networks is the overabundance of data. Sensory organs are part of an assemblage, including (but not limited to) a body. The body generates a constant explosion of enactments, even before senses are modified. It seems a daunting task to map out how the social is made sensible when even a single sensory organ provides too much data for the researcher. As a matter of practicality, it will have to be directed somehow. The second challenge with taking senses as within assemblages is I do not necessarily know how it acts for the person who has modified their senses. But how are these networks traceable? What if the object of interest is a modified human sense? What does it mean to say a sense acts? How is it *followed*? My intention here is thus twofold. First, I seek to understand the key implications of modifying sensory assemblages that extend outwards from the body, particularly since access to 'inside' the body is at times difficult. Secondly, from those conclusions I will be able to reasonably narrow analysis in the proceeding chapters' case studies.

Sensory networks: How do senses act as an assemblage?

To extend a sensory network outwards from the body implies starting at the body and its sensory organs. In some cases, it might be sufficient to focus on a single sense organ (e.g. when grinders attempted to extend the visual range) and work outwards. Attributing sensibility to Aristotle's five discrete sensory organs (seeing/eyes, hearing/ears, tasting/tongue, smelling/nose, touching/skin) came up frequently in my fieldwork, likely because they are immediately common to nearly all people – it is literally and figuratively *common sense*, a pervasive "folk ideology" (Geurts 2003, p. 7; see also Aristotle 1993[350 BCE], book II, chs. 6-7; Clements 2014). Such a taxonomy has been criticized, first, because there are additional organs associated with vomeronasal, proprioception, and vestibular (balance) senses (Macpherson 2011); and, second, in practice, senses are not isolated to their organs but combine to form complex assemblages.

For example, sensory organs sometimes work together, such as touch and sound at a loud concert (both feeling and hearing the sound of loud bass frequencies), and other times contradict or confuse each other, notably in the sound/sight illusion of the McGurk effect when distorted visual information can create aural illusions (Macpherson 2011). If we accept that sensory organs can combine or contradict to create other distinct senses, it becomes easier to consider other sensory assemblages, such as a sense of language, distance, time, motion, hunger, bladder stretch, and more (see Howes 2009). In fact, some cultures do not distinguish individual senses at all (see Geurts 2003). Moreover, synesthesia allows for cross modality of senses, such as the ability to see sounds or feel sights. Cytowic (2002) notes that synesthetes tend to be non-right-handed, 'bright' in the conventional sense, and exhibit excellent memories. He adds that a large proportion suffer right-left confusion (*allochiria*) and a "poor sense of direction for vector as opposed to network maps" (p. 2). In short, sensibility is tied up by much more than one-to-one assignments with a specific sense-organ.

Indeed, experiments like grinders' gambling on oxytocin are not conceived as modifying a singular sense, but rather as modifying a sensory assemblage (e.g. oxytocin, peer bonding, economics, trust, playing cards, Las Vegas). Once senses are thought of as assemblages, they become increasingly multi-dimensional. For example, Buckminster Fuller (1982) (whose books I noticed on several grinders' bookshelves) described a thought experiment of sensory ecology, wherein he isolates each sense to highlight the disparity of how bodies are positioned in the world by both distance and speed (see below) to types of senses. With a tactile object we are

limited to our immediate territory, and only at the speed at which we can move. Olfactory and aural information are sensed at increasing radii and velocities, respectively. The visual sense gives us the longest range and quickest velocity, allowing us to perceive distant galaxies.

Human sense ranging and information gathering

	Radius of Static Ranging:	Dynamic Velocity:
Tactile	1/1,000th of a mile	10 miles per hour
Olfactory	1 mile	400 miles per hour
Aural	100 miles	1,100 miles per hour
Visual	6,000,000,000,000,000,000 miles	700,000,000 miles per hour

Source: Fuller 1982, p. 437

Even though it appears Fuller is isolating senses like Aristotle, he is also identifying the *dimensions* of each sense to show what they have in common: senses are inseparable from conceptions of space and time. Fuller is focusing on the *depth* between the media entering the senses themselves, and this conceptual organization provides a useful alternative to defining a sensory assemblage by how it gets to the body. Though Fuller does not directly address synesthesia, the concept of sensory depth helps to clarify how organs can work in concert and/or antagonistically. Even when a synesthete sees sounds, this does not affect the above static and dynamic properties of 'information gathering.' For example, the tactile range and velocity of an auditory-tactile synesthete (i.e. someone who feels sounds) still follows the aural depth parameters, since the aural is how the information gets to the body. In other words, sensory mediations via synesthesia take place inside the body, thus they can be distinguished by the materiality of how the information comes from outside the body.

I argue depth is a useful concept for analyzing senses because it emphasizes how physical properties are directly implicated in the sensory assemblages. I suggest these processes are not linear, and they should be taken on a case-by-case basis. For example, yelling at people from afar versus directly in their faces means different things. The quality of intimacy changes when the range exceeds a person's touch. Tasting (which is absent from Fuller's list; presumably its range is 'zero' and velocity is near infinite) happens inside the mouth, which makes it very

personal and difficult for others to share – here we might think of the complicated (and at times controversial) practice of wine tasting (e.g. Brochet & Dubourdieu 2001).

In short, depth is an important aspect of studying senses, and in particular sensory modification. We cannot understand how sensory assemblages act without asking 'in relation to *what?*' So far, the cases of oxytocin and MK801 have implicated the relationships of public and private, as well as spatial and temporal dimensions of grinders' efforts to reorder the sensibility of society. I suggest that tracing their sensory assemblages outwards with this in mind can direct us towards the aspects of grinding that are most significant. The work of McLuhan is instructive in this regard, given his interest in the relationship between senses and emerging technologies. McLuhan, like the grinders in the Las Vegas hotel room, is interested in what can happen when senses are extended away from the body.

Sensory depth

The genealogy of grinding shares much with the counter-cultural co-formation of Silicon Valley, computer hacking, and digital utopianism. Rejecting institutional authority and rigid organizational structures, both seek to remodel (or even design) the world by increasing global connectivity through entrepreneurship and/or collaboration. The work of McLuhan (along with Fuller, for that matter) was influential in the emergence of Silicon Valley (Turner 2006), and his ideas have persevered into the grinder scene. McLuhan didn't shy away from critiquing what he perceived as the negative impacts of technology (Kroker 2014), thought it is his insights into the transformative power of extending the body via technology that are manifested in grinders' projects. A closer look at his oeuvre therefore provides insight into both the implications of modifying sensory assemblages, as well as into the techno-ideological undercurrents of why grinders might want to pursue such an action.

In particular, McLuhan's *Gutenberg Galaxy* (1962) has a lot to say about modifying the depth of the relationship between sensor and sensed. Though *Gutenberg* predates the advent of ANT, it shares an interest in the multi-directional relationships between human and non-human entities, and the analytical language is somewhat similar. In it, McLuhan's goal was to "*trace* the ways in which the forms of experience and of mental outlook and expression have been *modified*, first by the phonetic alphabet and then by printing" (1962, p. 1, emphasis mine). What follows is a mapping of an interrelated "*galaxy*" of objects and events impacted by these

technologies, made possible by "our rational power to *translate* all of our senses into one another" (1962, p. 5, emphasis mine). Though McLuhan lacks the empirical rigour afforded by thinking through specific actor-networks, he is essentially looking at more narrowly defined networks between senses and technology to identify different dimensions of sensing. In what follows, I will elaborate on three such (re)arrangements.

1: Mediating one sense affects all senses

To begin, McLuhan argues there exists a sensory economy whereby the mediation of one sense will affect the others. Whether there are five or some other number of senses, they are all tied together. In *Gutenberg*, McLuhan demonstrates how the invention of the alphabet makes it possible to translate audile-tactile information into visual information, which bolsters the supremacy of the visual over other senses. This has numerous effects, such as being able to connect people (through writing) at much greater distances. However, this comes at the cost of a loss of emotion or drama in communication that makes information seem neutral, resulting in a loss of direct personal significance. Alphabetical writing thus splits apart thought and action, while also making possible precise repeatability (e.g. the printing press), further enclosing non-visual spaces and senses into the visual.

McLuhan elaborates on other sensory mediations in *Laws of Media* (1988), where he organizes technological extensions into four dimensions of action. This tetrad, as he calls it, can be applied to any technology. First, the technological mediation will *enhance*, that is, intensify, make possible, or accelerate certain connections. Clearly, this is the aspect grinders are explicitly interested in, for example, using oxytocin to enhance trust bonds. Second, it will *render obsolete* or displace other connections. Frequently, grinds are based around obviating the need to develop a skill through practise (e.g. poker playing ability). These first two aspects of the tetrad alter the temporality of the oxytocin sensory assemblage by speeding up social bonding and eliminating the time needed to train.

Third, there is a *retrieval* or reconnection to older, previously obsolescent connections. Here, the effects of oxytocin work only in person, returning group cohesion to a sociality not found online. Finally, if pushed to the limit of connections (i.e. hyper-ubiquity), there will be a *reversal* that undermines what it originally enhanced. This last dimension is differentiated from the others as a forward-looking critique of the technology in question. If oxytocin use for

increasing trust became prevalent, any advantage gained would be rendered null if grinders (and everyone) were equally subjected to it. In other words, it'd be hard to win at poker if the grinder also (over)trusts the dealer. These final two aspects of the tetrad highlight how grinders attempted to alter the public/private dimension of senses by unevenly altering the temporal and spatial sensibility of the situation for participants, but at the same time sow the seeds for the whole thing to backfire.

2: Mediating senses affects how knowledge is organized

Second, privileging one sense over the others affects how knowledge is organized, around which an infrastructure is developed that (re)acts back onto the senses. McLuhan (1962) describes how the transformation of non-visual into visual knowledge makes it easier to abstract, organize, and transmit information. When visual-alphabetic printing reduces the sensory to the quantifiable, uniform, and repeatable, it dominates our understanding of the world by its appearance of detached objectivity (McLuhan 1988). Rath (2014), drawing from Kant, supports this assertion by arguing print was "a leading factor" in the conception, shaping, and influence of the enlightenment (p. 203). Organizing knowledge in print not only makes it possible to sort people by competency in grammar, McLuhan (1962) goes as far to claim that "Print, in turning the vernaculars into mass media, or closed systems, created the uniform, centralizing forces of modern nationalism" (p. 199). The ensuing advent of the 'electronic age' has only sped up and amplified reliance on the visual, as telegraphs, television, and the internet and their respective infrastructures solidified visual dominance. Even though vision almost always connects to other senses to 'make sense' (Massumi 2002, p. 145), the visual has become the prominent way of organizing the social (Bartram 2004; Tuan 1995), through literature (Synnott 1993), identity and gender (Halberstam 2005; Leppert 2000), maps and calendars (Birth 2012), to name only a few.

For those embedded in a predominantly visual mode (like myself), it is difficult to imagine other sensory organizations of knowledge. Luckily, anthropological examples abound of alternative sensory organizations' effects on cultural tradition, moral values, and formation of identity. For example, Geurts' (2003) ethnography of the Anlo-Ewe describes a culture centred around balance, sound, and kinaesthesia. Having good balance is a defining characteristic of maturity, and value judgments are made based on gait. A mother carrying a baby in the front is offensive, as it compromises (imbalances) walking. (I think a western equivalent might be

wearing sweatpants to a job interview – a visual *faux pas*). Other examples include the Kalapalo, whose story-telling rituals are organized by songs that must be performed with listener participation, which de-emphasize the boundaries between them, and reinforces group harmony (Basso 1981); or the Songhay, whose senses of language, history, personality, and agency are centred around the gustatory (Stoller 1997).

One approach to understanding how senses act, therefore, is to watch how information and knowledge becomes organized or reorganized. The sense will emerge in objects, language, and traditions. As a thought experiment, it is not hard to imagine how an effective oxytocin or MK-801 would re-arrange society, from contract law to romantic relationship. But even though neither has proven effective in such respects, that grinders are even trying to rearrange sensory assemblages suggests that something else in the sensory economy has changed. As much as grinders use technology to act, technologies are also acting on them, which is taken up in the next section.

3: Senses are not containable in the body

I have already argued that the actions of senses extend beyond the body, since they act in relation to something else. However, senses themselves can also be detached and re-attached to the body through reconfigured networks. As hinted at above with Fuller, there is a difference between senses acting inside the body and out. McLuhan (1962) differentiates internal and external sensory mediations. He describes internal senses as 'private,' contained in the phenomenological body, whereas exterior senses are any technological extension of the body (e.g. clothes extend the skin, telephones extend the ear, telescopes extend the eye). Importantly, senses do not necessarily stay in one category, as they can be interior*ized* or exterior*ized* (alternatively referred to as *outered*, or *externalized*). These processes respectively reduce or increase the possibility of entanglement with other networks, that is to say, the sense becomes more or less social. Certainly, a sense that is contained below the skin has a higher likelihood of being private, but this is not always the case. The importance of the skin to this analysis will be elaborated on in chapters 6 and 7, but for now I will focus only on sensory assemblages extending away from the body.

McLuhan displayed apprehension about the exteriorization of senses, such as writing things down instead of memorization. He claimed that "as our senses have gone outside us, Big

Brother goes inside," which will lead to "panic terrors" (1962, p. 32). The trepidation about exteriorization is not unique to McLuhan. Indeed, it is a predominant theme in posthumanism and science-fiction literature, where representations of the posthuman body such as Frankenstein (Graham 2002), the Terminator movie franchise (Tirosh-Samuelson 2012), Blade Runner, and Robocop (Shoffstall 2010; see also Bendle 2002; Keeling 2012) demonstrate how a technological extension of the body turns against itself, others, or particular groups of people due to technological interference. Like these examples, McLuhan's main concern is that, once exteriorized, there is no possibility for sensory "interplay among experiences" (Mcluhan 1962, p. 265).

The best example is the exteriorization of time, as time is an integral aspect of all sensory networks. I have already briefly touched on some of these ideas in previous chapters, but it is now worth expanding on to understand their political implications for grinders modifying their senses. Speaking at a general level, time can be conceived of as *kairós*, which is "opportune, proper, right, in reference to an action to be accomplished, to a decision to be reached, or to an initiative to be undertaken;" and *chronos*, an "external order, which marks and places a whole series of events in a linear and/or circular sequence" (Cipriani 2013, p. 10). As distinct as they may seem, there is a relationship between the two. Glennie and Thrift (2009) recount how Galileo originally formed his theories about the laws of motion by timing the period of a pendulum with his heartbeat. His results led to the development of increasingly consistent clocks, from which a pulse-rate could be calculated. The clock becomes the metric against which the body is measured (and disciplined, as Foucault would add).

What has troubled sociologists, anthropologists, and philosophers of time is how the externalized chronos has come to overwhelm kairós. Clocks make possible new organizations of life, from tradition and religious purposes, to disciplinary regimes of schools, hospitals and the military (Glennie & Thrift 2009; Foucault 1995). Nature and God became marginalized by clocks and watches, as "mechanical time replaced religious and natural authorities for dividing up the day" (Neustadter 1992). Through the industrial revolution greater portions of social life became subservient to chronos, as production and labour were increasingly directed by timepieces (Grossin 1993; Marx 1965; Thompson 2007, p. 496), which pervaded into everyday life in the forms of seemingly concrete deadlines and "scarcity of time" (Cheng 2017). Clocks

naturalized assumptions through not only structuring behaviour, but through infrastructural organization like factories, railways, and grain elevators (Bowker 1995).

Psychological experiments suggest exteriorized time then becomes interiorized. For example, in an experiment by Rotter (1969), researchers surreptitiously manipulated a laboratory clock being relied on by participants to rate the flow of time while reading. Participants attributed their perceptions to the artificially increased time elapsed, suggesting that "one's sense of the passage of time, be it affective or cognitive, can be manipulated by varying clock-speed" (p. 50). This provides some empirical support to McLuhan's (1962) concern that "Every technology contrived and *outered* by man has the power to numb human awareness during the period of its first interiorization" (p. 153). Drawing from Durkheim and König, Bergmann (1992) describes this process as a 'social time,' which exists outside of consciousness, yet "exercises an *external compulsion* on the individual" (p. 83).

The effects of such an external compulsion have been widely contemplated. Aho (2007) argues that the increasing focus on efficiency and the concomitant acceleration of mechanization leads to an "emotional exhaustion" as expressed in Kierkegaard's work on anxiety, Simmel on boredom, Marx on alienation, Weber on disenchantment, and Durkheim on anomie, among others (pp. 26ff). Anxieties about ever-increasing efficiency since the emergence of the internet has spurred contemporary scholars to consider how the dimensions of social temporalities have now accelerated to the point of collapsing into spatial temporalities (Bauman 2000; Kroker 2014; Terranova 2004; Virilio 2005).

Rosa (2013) considers acceleration the main characteristic of late capitalism, spurred by the perpetual interaction between technological change, social change, and an increased pace of life (see also Hassan 2009). On a broad level, Castells (2000) perceived globally networked society as compressing time until it disappeared, resulting in the establishment of a 'network institution' through an alliance of computer networks and decision-making processes. A prime example comes from Mackenzie's (2001) account of how Global Position Systems (GPS) are made up of a number of satellites and devices constantly 'tuning' to each other to maintain a semblance of synchronization to sustain global navigation (pp. 245-246). But these satellites, like all clocks, obscure the algorithms that drive them, which hides the dilemmas faced by their designers (Birth 2012).

Temporal dilemmas re-emerge on a more immediate, day-to-day level. Lee and Liebenau (2000) consider how globalized temporalities of the internet destroy the 'nine to five, five days' work week, since they make it possible to access work at any time, from any time zone. Moreover, clocks obscure how some workers are busier than others by measuring them both with the same minutes (Birth 2012), forcing some to scramble to catch up. Social processes become accelerated, expressed in the "time saving techniques in everyday life, shorter life-cycle of products, an ever higher pace of innovation, rapid prototyping, first-to-market strategies, etc.," which create further "perverse effects" like traffic jams and jet lag (Brose 2004, p. 6). Virilio (2005, 2012a, 2012b), possibly the most pessimistic of time scholars, describes how a sped up society erodes both the public sphere and the democratic process when increasingly-complex problems need to be dealt with decreasing access to resources, while at the same time increasing the reach of the military and 'turbocapitalism.'

Time is power, and when time is externalized it becomes a site of struggle about who can act and how. ("Speed is relativity and relativity is politics!" says Virilio 2012b, p. 26). But chronos is not the predetermined champion. It is possible to resist hegemonic temporalities. Ironically, sensation can interrupt common sense (Panagia 2009) when globalized clock-time does not line up with localized activities. Synchronization efforts frequently malfunction, particularly when one party wants to speed up while others want to slow down (Brose 2004). Western interests attempted to colonize foreign temporalities by exporting calendars and clock time to the world, but it was not completely successful in the case of the natives of Borneo (Postill 2002), the Karawaru (Telban 2017), nor the Inuit (Jackson 2000), each of whom consider clock-time as secondary (at most) to pre-established cultural temporalities. Moreover, feminist and queer scholarship provide numerous examples of gendered time, including how women experience and make use of time differently than men (e.g. in economic activity, Hantrais 1993; relationships to the future, Leccard & Rampazi 1993; non-normative organizations of community, sexual identity, embodiment, and activities in space and time, Ahmed 2006, Halberstam 2005). Since different senses of time are contentious, it follows that modifying the sensory economy may affect the outcomes of these controversies, particularly where modifications involve processes of exteriorization or interiorization.

If the clock has become the metric against which the body is measured, and if social temporalities have accelerated to the point of collapsing everything to *now*, the anxieties grinders

have about the world and their place in it (as outlined in chapters 2 and 3) are clearly present in their interest in oxytocin and MK-801. These substances represent one possibility of sensory politics, to catch up with accelerated society through altering the public/private spectrum of personal relationships. The temporal aspect of personal relationships would no longer be interior, but instead attributed to externalized biochemicals.

Conclusion

That sensory assemblages extend beyond the body allows us to draw three conclusions. First, even when it is not possible to access to inside the body, we can observe changes in the sensory assemblage that are outside the body. This might include how knowledge is organized through changed traditions, language, and so on. Second, grinders' modifications have potential to alter sensory depth, that is to say, how close or far socio-material entities are, by modifying spatial or temporal dimensions of senses. Time is an important element of senses and sensing, but, as scholars have argued, the "connections among beings alone make time" (Latour 1993, p. 77), and "speed is not a phenomenon by *the relationship between phenomena*" (Virilio 2012b, p. 26, emphasis original). Third, drawing from McLuhan's tetrad and other insights, we can already see how grinders are imagining unconventional temporalities where oxytocin and MK-801 might alter the depth (that is, the public/private dynamic spectrum) of personal relationships in order to manipulate time. At least as a thought experiment, the oxytocin experiment aimed to create a feeling of intimacy by altering whatever actants are involved in sensing trust, thus retrieving community. In contrast, MK-801 was theorized as creating a sort of detached peacefulness that would immediately distance unwanted feelings, thus retrieving privacy. Both substances sought to obsolesce the relationship process via a biochemical 'shortcut,' but also opened up the possibility of backfiring.

Even considering how experimenting with oxytocin and/or MK801 were conceived of as mostly a joke, there is much to unpack from grinders' interest in these ideas. They demonstrate how grinders' questions and modifications can start at the body and extend outwards, and also how the sensory body is acted upon. This not only provides insight into their culture, but also helps to direct our inquiry in a reasonable direction. The following chapters follow this direction through three case studies, which expand this inquiry to the significance of the subdermal sensory assemblage.

Chapter Six
Tricknology:
On the Question of Magnetic Senses

What is there in existence more inert than a piece of rigid stone? And yet, behold! Nature has here endowed stone with both sense and hands. What is there more stubborn than hard iron? Nature has, in this instance, bestowed upon it both feet and intelligence. It allows itself, in fact, to be attracted by the magnet, and, itself a metal which subdues all other elements, it precipitates itself towards the source of an influence at once mysterious and unseen.
- Pliny the Elder, *The Natural History,* written between 77-79

Certain bodies, as, for instance, the iron ore called lodestone, the earth itself, and pieces of steel which have bene subjected to certain treatment, are found to possess the following properties, and are called Magnets. If, near any part of the earth's surface except the Magnetic Poles, a magnet be suspended so as to turn freely about a vertical axis, it will in general tend to set itself in a certain azimuth, and if disturbed from this position it will oscillate about it. An unmagnetized body has no such tendency, but is in equilibrium in all azimuths alike.
- James Clerk Maxwell, *A Treatise on Electricity and Magnetism*, written in 1891

Fucking magnets – how do they work?
And I don't want to talk to a scientist.
Y'all motherfuckers lying and getting me pissed.
- Insane Clown Posse, *Miracles*, released 2010, and quoted at Grindfest 2017

The social powers of magnetism

The history of magnetism is a chronicle of transformation through orientation, reorientation, and disorientation. Possibly as early as 1000 BCE, the Chinese and Olmec used

compass-like devices for fortune telling and geomancy (feng shui) (Carlson 1975; Guarnieri 2014). In the 12th century, compasses ensured Danish churches were built with the choir facing eastward (Abrahamsen 1992). And of course, the compass has also been key to navigation for millennia, especially at sea (Guarnieri 2014, p. 60; Lane 1963; Lowrie 2007, p. 281; Merrill & McElhinny 1983), prompting Francis Bacon (1620) to declare the magnet to have "changed the whole face and state of things throughout the world" at a level matching the discoveries of printing and gunpowder (p. 66). While a magnet physically points towards magnetic poles, it can also point us towards what is socially important in a particular context: Chinese harmony between life and death, Danish religious alignment, and European economic trade routes or military strategy.

When grinders today expand sensory abilities by implanting magnets into their bodies, they also retrieve aspects from a long social history of magnetism and how its peculiar properties have restructured sensory networks. As the three introductory quotes illustrate, magnetism evokes rich and varied social accounts. Pliny the Elder wondered at its amazing properties, which is contrasted by Maxwell's passionless description, stripped of all social context and meaning in the pursuit of modern science. Yet as the Insane Clown Posse (ICP) demonstrate (jokingly or not), such a scientific explanation does not fully account for their modern effect on sensory networks.

A brief socio-material history of magnetism

Though having magnets implanted may be a recent trend, they have long been associated with the pursuit of social enhancement of one sort or another. The key to understanding such phenomena lies in the relationship between the invisibility of magnetism and the depth at which it operates. This invisible force that makes possible 'action at a distance' opens a space for speculation, imagination, and manipulation. Historically, the magnet's association with attraction tends to evoke explanations that quickly become entangled with metaphors for other natural and supernatural phenomena. For example, Pliny the Elder matter-of-factly declared the "leading distinction in magnets is sex, male and female" (77-79 Book XXXVI, Ch. 25). The common name for magnet in Chinese is *tzhu shih* – 'the loving stone' (Merrill & McElhinny 1983). Shu-Hua (1954) translates this into French as *pierre aimant*, or, "*pierre qui aime"* ('stone that loves'), and also further translates a quote by Li Che-tchen from 1580: "L'aimant attire le fer

comme une mère tendre qui fait venir ses enfants à elle et c'est pour cette raison qu'il a reçu son nom" (p. 175).

In the 17th century, Gilbert undertook the first extensive scientific examination of magnetism in an effort to dispel a number of myths that had accumulated to that point, including being an imposture of evil spirits, its potency for love potions, its ability to cure gout or spasms, and its 'essence' that "perturbs the mind the mind and makes folks melancholic" (np). Clearly, the magnet had come to be perceived as something that might render malady insensible or stimulate romantic connections. Notwithstanding scientific advances by Gilbert and those who followed him, such ideas were nonetheless repurposed by many others, most notably in the scientific movement called *animal magnetism* of the 18th through 20th centuries.

The term 'animal magnetism' was coined by Franz Anton Mesmer, and later also became known as mesmerism. Popular in France and England, its practitioners (also called 'magnetizers') mobilized magnetic properties to promote remedies that are imperceptible to the senses, and thus brought into question the connection between spiritualism and science (Schmit 2010). They claimed manipulations of the human state are made possible by acting on invisible magnetic bodily fluid. Such 'discoveries' were spurred in large part by the innovation of artificially manufactured magnets. Fara (1995) describes how magnetizers would take advantage of such cheap, reliable magnets to perform spectacles, noting how magnetizer Katterfelto "literally drew his daughter into the act by strapping a steel helmet to her head so that a giant magnet could lift her to the ceiling" in order to garner business for his 'Temple of Health' (pp. 132-133). During this time period the term 'magnetism' was sometimes used interchangeably with 'sympathetic,' making it easier to associate it with healing and sex, the ability to cure toothaches, and easing childbirth (Fara 1995). Such techniques were later influential in the development of scientific hypnosis (Hajek 2015).

French authorities attempted to discredit mesmerism, with great difficulty. Riskin (2009) describes how mesmerism was simultaneously absurd and plausible, thus blurring the line between science and pseudo-science. In fact, she argues it can be read as an anti-scientific parody of contemporary empiricism: if patients experience results, then there must be palpable effects of manipulating magnetic fluid. Any public inquiry was trumped by private experience. The commission attempted to credit patients' experiences to overactive imaginations, but that only begged the question of how to measure imagination if not in the exact same way as

'measuring' animal magnetism. The commission next attributed the effects to crowd psychology, an explanation which mesmerists then turned around and accused the commission members of the same for their persistent attempts to discredit animal magnetism. It was a conundrum born out of an inability to exteriorize the magnetic sense.

The historical social phenomena surrounding magnetism underlines tension between empirical and rational knowledge that remains to this day. While the physical properties of electro-magnetism are now scientifically better understood, the socio-material sensory networks of magnets nonetheless continue to be reconfigured through products like magnetic therapy bracelets that claim to improve blood circulation or stimulate a golf swing. In the Insane Clown Posse's song *Miracles* (2010), their anti-scientific position of the impossibility of understanding how magnets work stems from the same seemingly absurd position demonstrated in the mesmerism debate. They evince a predilection toward phenomenological explanations over taking someone else's word, and their position is only heightened by the audience's inability to discern if this perspective is serious or a parody. At Grindfest, references to the lyrics of *Miracles* were received and repeated with much conviviality. The social power of magnets endures scientific explanation.

Nonetheless, the social power of magnets is inextricable from its physical properties. An implanted magnet evokes two types of 'feelings' of magnetic fields: static and pulsing. The former is the straight-up attraction between a magnet and an magnetic object, which produces a 'pulling' sensation. The latter is the more interesting sensation, which is a result of a field that is rapidly expanding and collapsing multiple times per second, with each cycle pushing and pulling the magnet. They mainly come from alternating current devices, such as motors or power converters, and will vary by intensity and waveform, among other factors.

Recalling Fuller's scale of senses, an implanted magnet would have a dynamic velocity similar to the tactile sense (ten miles per hour), but it extends the range by approximately several millimetres to (by some contested accounts) up to ten feet. However, magnetic power is not distributed evenly. Though it ultimately depends on the shape of magnet's poles, the strength of the magnetic field drops off exponentially – approximately $1/x^3$ for a dipole, or even quicker for other shapes (where x is the distance). In other words, the strength of a magnetic field from a dipole magnet at one centimetre is a thousand times stronger than at ten centimetres, and a million times stronger than at 100 centimeters. Because of these physical properties, an extra

sense brought about by a magnetic implant is relatively intimate and private. It extends beyond the skin, though, practically speaking, not by much. This modest extension, which barely escapes corporeal containment, makes possible actions unparalleled by other sensory organs.

Though I've never met a grinder that believed anything about magnets beyond its electro-magnetic properties (e.g. claiming they have healing properties), their magnet implants nonetheless continue to make a social impact that exposes broader implications for sensory modification in general. In this chapter, I first work through the life-cycle of the implanted magnet to show what connects to magnets and what magnets connect to, but also how magnets disconnect. The first part centres around how a magnet implant is made possible, focusing on the socio-material aspects that enhance, yet are also limited by, the body. This section is about the craft of grinding, what it takes to alter a sensory network, and the practical difficulties of trying to interiorize a new sense. I then delve into an analysis of how magnet implants restructure sensory networks. The second part continues this analysis into grinders' extension of magnetic senses through peripheral devices. In particular, it focuses on how magnets reorder the visual and temporal. The two parts contrast how difficult is to make an interiorized sense with how readily exteriorized senses are mediated. The result is a mix of scientific modernism, a sense of wonderful exploration, and a penchant for trickery that alters how information circulates.

PART I: INTERIORIZATION

Where magnet implants come from and where they go

Oral accounts of the originator of magnet implants vary. For what it's worth, the wiki-style *Body Modification Ezine* encyclopaedia cites Samppa Von Cyborg as the first to experiment with implanting magnets in the late 1990s, and further implants were developed by Steve Haworth and Jesse Jarrell beginning around 2004 ('Magnet Implant' nd; 'So what's it like' 2007). In 2006, magnet implants began to gain attention outside of body modification circles following articles about Haworth's magnets *Wired Magazine* (Norton 2006) and *Make Magazine*.

Being able to sense electromagnetic fields attracted a new audience beyond the body modification scene in the emerging grinder movement due to its practical (as opposed to aesthetic) applications. The magnet implant is the quintessential sensory augmentation example

for grinders for not only what it does, but what it represents, since "…having a magnet implanted in your body literally changes your sense of self like no wearable tool could. It re-wires your brain to interpret the sensory input coming from those specific nerves in a new way… that is part of the fundamental essence of what biohacking is all about" (Graafstra, 'Quality matters' 2016). In interviews, grinders described getting a magnet as a rite of passage, an initiation into the community, and the "introduction to everything" that is grinding. While it's not required, Max explained how "it'd be fine if someone didn't have one, but I'd be kind of like … come on man, just get the magnet." However, there are impediments to 'just getting' a magnet, as they are not exactly straightforward to produce and implant.

Making magnets happen

Despite grinders' best efforts over the past decade, acquiring an affordable magnet to self-implant has become increasingly difficult. Of course, the alternative of going to body modification artist like Steve Haworth for a readymade is always an option, but it is expensive, has a lengthy waiting period, and would bypass the experience of learning the intimate details of what is about to become a part of the body. Haworth's website claims to only sell magnets to body modification professionals[20], and so the grinder is left (often happily and literally) to their own devices.

The immediate considerations for choosing a magnet are its strength, size, and shape, all of which are related. As to strength, it may seem obvious to want as powerful a magnet as possible to counteract the exponentially weakening magnetic field. Once implanted, however, it quickly becomes clear that having ferromagnetic objects pinching your skin is not only painful[21], but might also cut off blood flow and lead to necrosis (cell death), which can further lead to other health problems such as gangrene. As far as I know this hasn't happened yet, though the existence of such a possibility is often repeated in the grinder community.

As for shape, the most popular is a three by one millimetre convex disk, more commonly represented as an *M31*. The M31 is a product originally developed by grinder cooperative Science for the Masses, and sold by Dangerous Things. Jeff, one of the M31's original

[20] Though I've heard reports that mechanisms to enforce this claim are lacking.
[21] The inverse is of course also true –a weak magnet implanted in your hand attracted to a strong magnet outside your hand will cause just as much pain.

developers, explained to me that its shape is optimal for achieving the minimal amount of mass with the maximum useful field. Its disk shape also allows the freedom to spin or 'flip' around once implanted, thus enhancing sensation. One alternative to the disk is a rod, which does not flip, though the shape of its field provides a sense of flux direction (that is, the direction of its magnetic flow). Ben has also experimented with washer-shaped (donut) magnets with some success. Though some were skeptical that the skin in the 'donut-hole' would live, there was no indication of such problems after a six-month removal for inspection.

Beyond strength, size, and shape, the most important decision when choosing a magnet is bioproofing, that is to say, how to make it safe for implantation. Interfacing technology with the body must, of course, take its biological form into account (see Parisi 2015). There are two related impediments to making a successfully bioproof magnet: materials and testing. Neodymium is the material of choice, being a permanent, strong, rare earth magnet (technically an alloy of neodymium, iron, and boron). However, the best case scenario of implanting a raw neodymium magnet is the body will reject it much like it rejects any foreign object (e.g. a sliver). Worst case scenario, since neodymium reacts to both oxygen and water, it will oxidize and break down into the bloodstream. To avoid oxidization, manufacturers commonly coat neodymium with nickel, but this is even less suited to implantation since internal exposure to nickel causes heavy metal poisoning in humans[22]. A neodymium magnet therefore must be further coated in something that allows it to stay inside the body, yet separate from the body. This bioproof coating acts as the magnet's skin, a barrier protecting both sides from chemical interaction.

There are many factors to consider when choosing a bioproof coating. Interestingly, many coatings do not bond with tissues in the body, which means an implanted magnet might migrate to some degree during its 'settling period.' The alternative is a coating that will bind to the skin and stay where it was implanted, but as Ron pointed out to me, "the problem is then it binds to your flesh, and it's not just anti-migration – it's anti-removal." Even before implanting, a person must commit to *how much* the magnet should become attached to them. Moreover,

[22] The symptoms of heavy metal poisoning include nausea, headaches, vomiting, and, if left untreated, death. However, myself and other grinders have had magnet coatings fail and I've never heard of any experiencing any of these symptoms. I assume the magnet is too small to cause significant damage, though I am including this information for the sake of completeness and as a caution to any reader who is considering getting a magnet implant.

since magnetic field strength diminishes exponentially by distance, the ideal coating must be relatively thin – adding even a millimetre can significantly lessen its efficacy.

Sourcing a manufacturer of neodymium magnets is easy, but exactly how they are coated is not always provided and rarely adequate. Some manufacturers will ship magnets with coatings that should be bioproof in theory, like parylene or gold, but the coating may be applied unevenly or come apart due to the manufacturing process. For a time, parylene had something of a bad reputation on the biohack boards, which Marlo argued was undeserved. "The reason for that is because someone got a shit batch from China; they actually used an epoxy instead of parylene, which is brittle and totally just flaked off in people." In Frank's experience of ordering magnets, either "they're not coated or they're coated in death." Moreover, insisting the manufacturer provide this information to ascertain its suitability for implantation in humans is all but guaranteed to terminate both the sale as well as any further correspondence. Without knowing what a magnet is really coated with, what choices are there? Grinders' solution is to take charge of the coating process and DIY.

Beyond the early coating experiments with Sugru and dental resin, which had high failure rates, varying degrees of success have been found with diamond, certain FDA implant grade glues, and titanium nitride (TiN). In theory, these should all work. In practise, however, each of these solutions has failed at one point or another. Only a handful of diamond coated magnets were produced, and not only was the process going to be cost-prohibitive for mass production, over half of them failed within a year of implantation. Using FDA implant-grade glue has worked, though it must be applied by hand and has proved difficult to apply evenly. Applying TiN requires specialized tools, but a batch of magnets can be sent for coating at a factory. No matter which avenue is chosen, it is prudent to test whether, once applied, a coating is sufficient. There are two ways to do this.

The first and original test for bioproofing was to rely on the substances' documentation, apply it, and then implant it to see what happens. For the dental resins, Jeff recalls how "the failure rate was relatively high, but I didn't know if that was because of the material I used or if it was because [of the] people doing it." Expanding on this latter point, Marlo explained how material properties of parylene factor in: "I think also in some cases they've been put in with … an instrument with sharp jaws and the instruments bit through the plastic. You have to really watch out for that. [Parylene] has an incredible tensile strength and chemical resistance, but it

punctures easily." While there have been numerous attempts on the biohack.me board to determine 'rejection' rates for various coatings, the gathered statistics are largely useless since they leave the same questions:

> Well, did the coating work or did the coating not work? […] You know that the coating is okay, but is the coating adequate? […] It's real difficult because it's like you'll implant them and they'll fail after six months to a year, something like that. And then it's like, oh, guess you got a bad one, sorry, dude. A lot of them are still pretty good. There's still some that people have that haven't failed or whatever, but … [trails off] (Jeff)

Whether a coating 'works' or not depends on its chemical make-up, how it was applied, how it was implanted, plus any factors unique to a person's body chemistry or lifestyle. Further compounding this ambiguity is one cannot observe how the implant itself is doing, given it is hidden from view. Implant it and wait, while monitoring the surrounding area for swelling or discolouration, or if magnetism is getting weaker. Some, like Ben, have taken to implanting unique coatings for increasing amounts of time – a week, a month, six months – and cutting them out to see how they look. This is, of course, time consuming, and it also leads to a build-up of scar tissue.

The second test for coating failure is to subject the magnet to chemical evaluation prior to implanting. Simply drop one in a solution that would cause a reaction with the magnet but not the coating, and wait. If the manufacturer already coated the magnet in nickel, a nickel exposure solution will turn a pink-red colour if the secondary (i.e. bioproof) coating is breached. If it is not coated in nickel, there are still other options. After consulting a chemist, McSpanish decided to test a batch of TiN-coated magnets in sulphuric acid. His batch failed after about three weeks, which may even have been acceptable since sulphuric acid is a far harsher environment than the human body. The simplest and quickest test, however, is to drop the magnets in a saline solution (a far closer analog to the human body) with a drop of dish soap to break the surface tension. To date, ordering bioproofed magnets from manufacturers has proved mostly unsuccessful. "I just have to laugh at myself for cleaning them in acetone and putting them in 93 percent pure sulphuric acid," said Stephen. "All I needed to do was use the neti pot salt I already had and the

dish soap that's in the kitchen. […] Every one that I've put in has failed, so I've stopped testing." Jeff has reached a similar conclusion when trying to find a new source for M31s: "I probably tried about six different companies and I got samples made, and all of them had fails in the first test batches. So that's why I kind of gave up on titanium nitride."

Preparing for implanting magnets

Once a (probably) bioproof magnet is obtained, it can go into the body. Some call this process *implanting*; others prefer the terms *installing* or *upgrading*. While the location for all subdermal implants need to be carefully chosen, magnet implants require special consideration. In order to achieve the maximum effect of sensing electromagnetic fields the magnet must be placed in an area rich with nerves. Once healed, electromagnetic frequencies will vibrate the magnet and stimulate the adjoining nerves, resulting in a distinct sensation.

The decision of placement ultimately comes down to discoverability versus discomfort. By far the most common location is somewhere in a nerve-dense fingertip. More specifically, the outside of the ring-finger of the non-dominant hand is considered the ideal site. Jacob explained to me he chose this location

> …because it's out of the way, right? If you were holding a nail, you're going to use your pointer finger and your thumb. Your pinkie, you're more likely to slam against a door or something. Your middle finger I feel like lacks the dexterity of the ring finger. And then I had it on the outer side because it felt easier to bring into the world, I guess. Like I could reach out easier, whereas if it was on the inner part of my hand you'd have to move your hand into an odd position to get it really close to something.

He then demonstrated how awkward it would be, contorting his whole body to place the inside of his ring finger down on a table. The more appropriate the placement for discoverability purposes, the more likely the implant is to get in the way.

Reports of physical discomfort or interference due to magnet implants vary, and they identify difficulties in magnetic interiorization. Many people reported no problems whatsoever with physical activity, and are able to participate in rigorous exercises like rock climbing without a second thought to their fingertip magnet. Others – myself included – suffered the occasional

minor soreness caused when the magnet was accidentally bumped or jostled. Even though it is tiny, the magnet can interfere with gripping objects, as its subdermal proximity to the nerves augments sensitivity to pressure. By most accounts the area is a bit more sensitive, though it won't prevent doing ordinary tasks. The exceptions tend to be people who work with their hands. One welder's magnet had to be removed after getting a small cut nearby, which then became irritated by the attracted iron filings. Likewise, Justin A's magnet rejected shortly after accidentally smashing it with a frying pan. Despite enjoying it while it lasted, he's decided "I can't really do a magnet again because […] it gets in the way. I need my hands." Evan, who also works with his hands, opted for more awkward placement of the inside of the ring finger for just this reason.

One thing I noticed about magnet implants is the level of protrusion from the finger also varies widely. Some magnet implants are imperceptible, nestled deeply enough to conceal the upgrade, and others end up with what almost looks like a mole. Though bumps were more common in people with thin fingers, I also saw some serious sausage fingers with a noticeable quarter inch protuberance. Such a bulge can become significant for two reasons. First, several people complained it is like a scratch on the top of your mouth – it invites constant, even if unintended, probing by the other fingers that leads to agitation. I experienced this myself with a ring-finger implant that my other fingers didn't want to accept. Second, a bulge can ruin the concealability factor. One appealing aspect of implants is that others don't know you have them. Invisibility is important, as Jordy admits how "at the end of the day I still want to look human … I kind of want my chips and my magnets and everything to be sort of a secret that people don't know about unless I tell them or show them … I don't really care what people think of me but at the same, though, I still need a job." When discussing my research with others it usually came up that I had up to three magnets implanted in my left hand (outside ring finger, outside thumb, outside palm). Of the few people that had noticed them before this revelation, most assumed it was a mole.

Sensory magnets have been implanted in other locations, like wrists and arms, though the effects are reduced or non-existent. One notable placement is in the tragus (the skin flap by the ear). This area is not sensitive enough to feel electromagnetic waves, however, a nearby induction coil can be used to make it vibrate at a hearable frequency. I've also heard third-hand

reports of magnets being implanted in the genitals, though I've never been able to confirm this. The grinders I've spoken with tend to prefer the fingers or tragus due to its practicality.

With placement decided, the next step is to finally get the magnet implanted. Nowadays, going to a body modification professional is sometimes possible, though it will be expensive and you may have to travel, or wait for their travel schedule and availability to line-up. Grinders tend to take one of two alternatives: You can do it yourself, or you can find someone to help you out.

In the earlier days of grinding it was more common to perform self-implantation. There were fewer experienced implanters, and the DIY ethos inspired by Lepht Anonym was perhaps more pervasive at the time. Within a week of reading Lepht's blog, Marlo had to try it.

> I did the same procedure [Lepht] did, which was to buy a magnet from a supplier on the internet, just one that you might use as like a fridge magnet or something, a tiny little neodym. It wasn't one of the forty-fives[23]. It was a really crappy grade, wasn't that strong, [and] four by three millimetres, so pretty big. I went to the hardware store and got some Sugru, moulded it around it with my fingers, soaked it in iodine. Iced up my finger, cut a hole in my finger, put it in my finger, superglued it up, crossed my other fingers and see how it went – and it actually worked pretty well. It healed and was actually – wasn't very sensitive, but it worked. I could feel current flowing in wires and things, and it actually lasted for about a year and a half before the Sugru broke down and it rusted in my finger.

Working on yourself presents a number of practical difficulties. First, putting a magnet in one finger means that hand will be of limited assistance to the procedure. Second, there are physiological and psychological barriers to cutting oneself open. Berkelly, under Jeff's supervision, told me she passed out midway through the process. I asked her why she wanted to do it herself, especially since Jeff was present, and she told me "I just thought it'd be cool to do. I think also having the experience and knowing how to do it is also part of the whole movement."

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[23] Referring to the N45 gauss rating of magnetic field strength. For reference, a Dangerous Things M31 is around N52.

Self-implanting is both a physical and mental test of boundaries, and the intentional self-infliction goes beyond the experience of everyday accidents. Matt compared his attempt to previous workplace injuries, telling me, "I mean, I've cut myself worse in construction than I have doing this, so it wasn't too big of a deal at any point; just doing it yourself is a huge deal – like, purposely. That was not fun. I probably would have stopped if somebody hadn't been watching me. It's painful." Cutting oneself is a deliberate choice, and though some grinders prefer to do it themselves I never got the impression they relished the pain. "In doing stuff yourself, your body tells you: don't – do – this," says Ben, emphasizing each of the last three words before elaborating:

> So you're shaky because it's like your scalpel's five pounds. It's because your body is subconsciously resisting and you're having to consciously overcome it. It's almost like you're fighting your own muscles, you know? Your body's trying to pull back [...] It's like your willpower tells you you can push through this, so it's – I don't know. It hurts like hell, though.

After a semi-failed attempt to guide his friend through the process of implanting his magnet (it was too shallow and rejected after a month), Zac described how much persistence is required when taking on the task himself:

> And so once I dug as far as I could with the scalpel, put the magnet in there and it was only halfway in and the other half was poking out. And, I mean, I really don't know why I kept trying, but I was cutting myself for four hours, which is obviously a super bad idea to have. Like, a wound continuously going for four hours in your kitchen. But, you know, it's super late, I was super tired, and I just -- I wanted it in there. So what I did was I just sterilized the back end of my scalpel and spent like another half hour just slamming it into the hole until eventually the edge was just level with the skin. Still wasn't even enough for me to close the skin over, but it was level with the skin. I was like, that's not going to stay but I'm not just going to take it out right now. So I bandaged it up and sure enough it stayed. And I totally figured, especially during the hammering of it, it had to have damaged the coating, but it's been there for about

three years now.

Zac later implanted a magnet in his friend over the course of just 15 minutes, a much easier procedure, he said, since "I don't have to feel his pain." That said, even with reading as much as possible about the procedure and watching tutorials online, he admitted there is no substitute for experience. "Once you have your finger cut open … you don't know what it looks like or how deep it's supposed to be. You're really still just kind of flailing around until you get some sense of what's going on. I mean, obviously [reading tutorials] really helped, but I feel like you don't really know how to do it until you have done it before … It's such a small operating field and the suturing is so small, you can't look in there. And I mean, it's really you just have to do it by feel, and no matter how much you read you're never going to really know how it feels."

Experience plays a large part in deciding how to go about implantation. Many grinders told me they are more likely to get implants done because they already know someone who can do the procedure for them. For those near the west coast that tends to be Jeff, and his proximity was frequently cited as the deciding factor for getting an implant. For those without such a luxury, who don't want to work on themselves, are likely to pass out, and/or don't have any adventurous like-minded friends, they have to find someone else. The quest usually begins by phoning nearby tattoo or piercing shops to see if they've heard of such a thing, or if they know anybody who has. Once some leads have turned up, then begins the difficult part of ascertaining whether the person is competent or sketchy. Frank once called a piercer whom he quickly learned had never even heard of magnet implants, but after only a brief explanation was eager to do it. Frank did not accept.

Complicating the search for competent implanters are the laws affecting piercing and body modification, which change by state and sometimes even by county. Since many piercers or body modification artists don't want to run afoul of the law, they tend to err on the side of caution when it comes to using (or in some jurisdictions, even having) scalpels or sutures, on top of any liability issues. But this doesn't mean it isn't possible. One effective strategy is to convince the person that you have done your research and are familiar with the procedure and its risks. This establishes enough trust that either they may perform it themselves despite the risks, or vouch for you with another professional who will. Following this route, having an implant done by someone who does not want to be identified is closer to the rule than the exception.

Even Ben, who had previously performed implants on himself, opted to go to "an underground [piercing shop] -- had to go before business hours, pay in cash, 'you never tell anyone I did this.'" Because its illicit spectre stifles the sharing of information, the styles and techniques of magnet implantation among piercers and body modification artists runs the gamut of quality. Most turn out okay, but there are more than a few stories recounting the questionable use of needles to dig holes in fingers, or providing only a Band-Aid to 'close' open wounds.

As the grinder scene grew and information became more widespread, there was an increased willingness help one another. There is still some degree of needing to be vouched for, and no one that I met condoned implanting minors. Even though access to implanters has improved, it's far from an ideal system and grinders are still cautious about working on others.

> So it kind of sucks, so that's why I've kind of turned into the -- if you want one of these done here, either go to a piercing shop and have it done illegally or have me do it […]. So, start with one person, and then if they have a friend who saw theirs that vouched for them, then I'm like, yeah, okay. But … I've had random people message me that I'm like, no, sorry, not really doing anything right now because I'm -- I just don't want random-ass people coming over to my apartment and letting me cut them open. You know? I like to have a friend of a friend kind of a system. Like a reference, almost like invite-only. (Ben)

The ordinary procedure

The implanting procedure itself is relatively straightforward with only a few choices that need to be made. At Grindfests, Jeff repeatedly emphasizes that tools must be properly sterilized, the implant area should be disinfected, and implanters should wear surgical gloves. However, as I've already explained, this is not always the case when others DIY. Beyond this, a personal decision must be made about the use of painkillers. Some opt for lidocaine, whether injected or topically applied. When painkillers are neither preferred, available, nor legal, there are a few other options such as using ice baths to numb the area or drinking alcohol. The final option is to use nothing. Ben tried this once, deciding "I feel like it's almost like a rite, like you earn it if you don't numb it … it's part of the process. At least do one at some point just to be like a full experience, the whole gamut."

Over several years I've seen or assisted Jeff conduct dozens of procedures inside his self-made, fully equipped surgical room. I acted as his *floor bitch*, which he assures me is a term of endearment he picked up from working at a hospital. It was my job to maintain the sterile environment and retrieve tools or supplies from the numerous cabinets and semi-carefully organized plastic boxes. Once a procedure begins, Jeff will rarely move away from surgical room's crown jewel: a reclaimed, electrically adjustable dentist chair from the 1970s. Any task more than a foot away from the chair usually became my responsibility. This occasionally included queuing up the industrial rock band *Nine Inch Nails* at an appropriate volume – loud enough to discourage any onlookers from excessive discussion, but not so loud as to be distracting itself. Over time, I noticed Jeff increasingly opting for earplugs over music. Outside of the surgical room Jeff is known as a joker, a storyteller, a provocateur, but when next to the procedure chair he becomes focused on the task at hand. If he can't help but make a joke, he first takes a step back from the chair and stands up straight. Otherwise, it is a serious affair – no taking risks, no pretending things aren't exactly as they are.

A magnet implanted by the inexperienced can be a bloody, time-consuming mess, but for a seasoned implanter the procedure takes less than five minutes. Jeff makes only a few controlled slices with a scalpel, while Ben prefers to make one deep cut to get through the first layer of skin. It is helpful to next cut a pocket beneath the epidermis for the magnet to sit in so that it won't immediately pop out. Using non-magnetic tools, the magnet is inserted into the newly created crevasse. Sutures or medical glue close the wound. If you're not squeamish the whole thing seems almost ordinary.

The very ordinary post-procedure

After having a magnet installed, people often comment – some joking, and some completely seriously – about now having become a cyborg, on the way to being a science-fictional trans-superhuman. Yet the ensuing weeks of healing are marked by vulnerability, patience, and heightened caution. The quest to become 'more than human' is more often a reminder of how frail human bodies are, and the recently-implanted have to slow down their pace of life to optimize the healing process. Of course, like tending to any deep cut in the skin, Jeff recommends the area be kept clean to avoid infection and applying ice to reduce swelling. Failure to do so may contribute to the implant being rejected by the body, though it isn't always

predictable. For example, Justin A took a month off from parkour and climbing since he couldn't perform without putting excessive pressure on his finger. In contrast, Berkelley eschewed such precautions and went hiking in the woods within a couple of days. Yet in the end, Justin A's ended up rejecting (he accidentally smashed it with a pan), and Berkelly's, even though it looked grim for a while, ended up healing completely.

However, it is not only the skin that has to heal. The nerves around the magnet often take time to regrow before any electromagnetic fields can be felt. Some people reported feeling electromagnetic fields as soon as the sutures are tight, while others feel nothing for up to six months. The latter case is disappointing, as there is thus a period of extra-*ordinariness* before being able to feel *extra*-ordinary. Todd described how "it was always like I wanted to feel something and so I would just put my hand across things like, 'When's it going to happen? What's going to happen?'" And until the sensations begin, there is patience and anticipation:

> There were two weeks of just constantly worrying. Not so much worrying about something bad happening -- I was very happy to have it. I didn't want it to reject. Just from getting sensation right away, it was like I didn't want to lose it, didn't want to have to go through the process of going out and getting it done again … As far as healing, everything healed fine. There were a couple times I bumped it that I thought it was going to come out in the first two weeks, but once the actual incision healed over completely at that point it was pretty much worry free. (Evan)

The common experience is that sensitivity reaches its peak at around a year after implantation. Then, finally, extraordinary sensory networks start to emerge, providing access to electromagnetic sensations.

Where magnets take you and where they leave you

Since experiences of post-magnet implantation are now well documented on the internet, it takes some of the surprise out of becoming familiar with a fresh implant. For early adopters like Jacob, whose first implant predates the biohack.me boards, the lack of widely-published expectations provided unique insight into how bonds are formed.

> I wanted to feel things immediately, and the sensation really took a while before it started slowly … but it was probably a couple of months before I was fully healed, or fully in tune. But the thing that surprised me, actually … the sensory perception didn't kick in as soon but it was less what was internal, like what I was feeling, and it was more my sense of external agency. Like the fact that I could put a ball bearing on the table, and from two or three inches away just kind of drag it around. That wasn't something that anybody told me I would be able to do, especially since the parylene magnet is significantly stronger than [an M31 is now]. … And so that sense of being able to move things without touching, I remember the first year I would bend a paperclip up just a little bit and put it on the table and just drag it in circles, you know? And from an inch away, having a conversation with somebody and moving this thing back and forth without touching it. … And also, being able to get a sense of how ferrous an object was by touching it, I think people had mentioned a little bit but I didn't grok it until I actually experienced it myself.

Jacob was not the only grinder to make use of *grok*, a slang term derived from the classic Robert A. Heinlein science-fiction novel, *Stranger in a Strange Land* (1961). In the story, the first Martian (named Mike Smith) to come to earth makes frequent use of the term, though the characters (and the reader) are left to ascertain its meaning by how Mike Smith applies it throughout the novel[24]. To grok is to understand, but it's not just an understanding – it's more

[24] Notable examples of 'grok' from *Stranger in a Strange Land* (Heinlein 1961)
"'You grok,' Smith repeated firmly. 'I am explain. I did not have the word. You grok. Anne groks. I grok. The grasses under my feet grok in happy beauty.'" (p. 192)
"He was beginning, he thought, to grok 'business,' 'buying,' 'selling,' and related unMartian activities—the Encyclopedia had left him unfilled, as (he now grokked) each article had assumed that he knew things that he did not." (p. 316)
"In kissing her he grokked that this gift was what she wanted and that it made them grow closer." (p. 319)
"…'the greatest difference between the two races is that Martians never hurry—and humans always do. They would much rather think about it an extra century or half dozen, to be sure that they grok all the fullness.'" (p. 560)
A non-Martian character at one point thinks to himself: "'What was 'grokking'?' He had been using the word for a week—and he didn't grok it." (p. 190)

like a deep empathy arrived at through experience, not through mere description. Grokking is a sense that facilitates affective relationships with moods, concepts, objects – and objects can grok, too. As the characters come to understand what it means to *grok*, they also come to understand Mike Smith. It's a fitting term, therefore, to describe how magnet implants open up a sense of discovery for alien relationships between humans and objects.

Feeling something with a magnet is not the same as touching it, and when I asked grinders to describe it they would often struggle for adjectives. "It's -- yeah, it's difficult," said Jordan, pausing for a moment before continuing, "Kind of like a tingling I think would be the best way of describing it, but not an uncomfortable one. So it's like a persistent, not ticklish tingling in the area of your finger, but it doesn't feel like really anything else. It doesn't feel like a vibration. Feels like an internal tingling, which is kind of spooky but also really cool." Not only is the sensation difficult to describe, Proxy explained how this difficulty extends to locating what precisely is causing it. He told me how "sometimes when I am walking through areas and I'm not expecting something to be emitting a field I will have a moment of confusion as to what is going on … it's semi-tough to explain … you can basically picture it, like, as a wasp sitting on your hand buzzing .... But instead of it being a touch sensation you just feel it, more so. So, yeah, sometimes when I'm just walking through stores I'll just feel something is strange and then I'll notice I have my hand probably next to something I shouldn't."

The difficulty in describing a new sense has important implications for the future of sensory modification and design, and in particular how they interact with existing sensory networks. Consider the following three examples. First, a study on neuroplasticity (Blakemore & Cooper 1970) involved raising kittens in cylinders that constrained their ocular exposure them to only to vertical stripes or horizontal stripes. After five months (when the visual cortex in cats has developed), they were released to a well-furnished room and observed. The cats were "virtually blind for contours perpendicular to the orientation they had experienced" up to that point (p. 478). Eventually their vision improved, though they remained permanently clumsy and would sometimes reach for objects well beyond their range. Therefore, it is possible that grinders, being adults, are not exposed to such sensations early enough to develop maximum acuity. In other words, they're just not good at it yet. As such, attempts to describe their sensations may be like grasping at objects beyond their capabilities (see also Howard 2012 for a wide range of neuroplasticity research on the development of perception).

Second, there is research on cognitive penetration theory that suggests brain function manipulates perception (Macpherson 2012). In a classic study by Delk and Fillenbaum (1965), participants were to adjust the colour of a background screen, ranging from yellow to orange to red, to match the colour of an object placed in front of it. The objects were made of orange paper, some of which were shaped like things that are characteristically red (e.g. a heart, an apple, lips), while others were not. For objects that are 'supposed' to be red, participants would adjust the screens to skew red rather than 'correctly' matching the orange paper.

My first experience with a magnet implant exhibited similar results. Having abstained from going near anything magnetic for several weeks out of concern for rejection, one morning I decided the nerves had probably healed enough. I leaned over to a fan, extended my ring finger towards its rear-mounted motor and felt only a cool breeze. After a disappointing several seconds, I realized the breeze was felt only on the implanted finger. It felt exactly like the breeze I was expecting, until I realized it was not. When placing my hand in *front* of the fan, I 'remembered' that a breeze feels quite different from the magnetic field. This suggests previous experiences may influence the perception of new senses, and therefore how it is described (see also Zeimbekis & Raftopoulos 2015 for current research on cognitive penetrability of perception).

Third, research from cognitive scientists and linguists suggests that language influences (but does not *determine*, Lucy 1992) thought, decisions, and perceptions of reality, especially in cases of cognitive uncertainty (Regier & Xu 2017). The theory suggests language is a fundamental part of being able to learn abstract concepts (Perlovsky & Ilin 2013). Words therefore constitute theories about experiences or interactions of the world (Baake 2003). Moreover, using the same word (or metaphor) does not necessarily equate to the same meaning. It is significant, then, that grinders both lack an established vocabulary to describe their magnetism and seek the words to do so anyway, as they may come up with competing or contradictory ways of 'making sense' of their new sensations. For senses, Majid and Burenhult (2014) found that odours, which urbanized Western societies find difficult to identify, are as easily and concisely named as colours for the Jahai of the Malay Peninsula. They argue this is possible due to linguistic precision in naming the smell itself as opposed to naming the source (e.g. it smells *like* a banana), suggesting this ability is socio-culturally developed. By sharing their experiences of magnetism with each other (even online), grinders may be forming what it

means to be magnetic for others.

These three examples suggest that sensory networks reach into neuroplasticity, previous socio-cultural experiences, and language. Therefore, it is not surprising when grinders cannot fully describe sensations, or when they come up with completely different meanings for their sensations, whether their implants feel sort of fuzzy, they're prickly or lumpy, they knock, they kind of vibrate, they buzz, or they exert pressure. And while my list of magnet implant adjectives grew after each interview, I quickly learned that when mapping sensory networks it is much easier to work outwards from specific experiences of objects rather than the implant sensation itself.

Sympathy for the metal

Nearly all my interviewees recounted being asked by friends, parents, and journalists why it was worth feeling electromagnetic fields. Matt's standard response to such questions is that "you could live without your sense of smell – without really any [senses], obviously, because people do. You can live without any of them. So why do you have any of them? You find uses for them once you have them." And though these practical reasons are rarely the primary attraction, grinders have indeed found an implanted magnet to provide pragmatic solutions for unanticipated situations.

Electromagnetic powers have a way of reinforcing the sensory networks of everyday routines. As one might expect (particularly those who work in IT or deal with electronics hardware), magnets are good for picking up tiny screws or determining whether the contents of a box are ferrous without opening it. They are also useful for solving electrical problems. Amanda was able to quickly track down a faulty circuit in a stove, and with the wave of his hand Proxy can diagnose whether a fountain is not working due to a broken motor or if it's only clogged. When Matt's charging laptop was "stuttering," he didn't have to worry about repairing it since he could sense the problem was actually related to the wall outlet.

Magnets provide an almost sympathetic insight into objects and how they work. A grinder in charge of intake at a second-hand store refused to sell a vacuum cleaner because it didn't feel quite right. Jacob has precognition about electric busses in San Francisco, which create a surge of power before acceleration: "You can feel this *vvvooooomp*, and then the bus starts moving, right? And so when you're standing in a crowd of people I can tell before we

move, and prepare myself for the lurch of the bus. And that's always a really sharp peak … like, just, *shhhh-kuh*!"

Another grinder who also does urban exploration was once deep in underground tunnels when they noticed they could tell which wires were live. "It was probably 48,000 volts, or whatever they step it up to do those long distance hauls, and however much power that took … it was pretty intense. You could get the vibrating feeling all around that whole tunnel area. Like, you could feel it. You knew you were in something. And then when you got your hand right over there and you put your hand on it to climb on it or something, or touch those power lines … nothing has ever come close to that" (Anon).

While visiting Las Vegas, Stephen realized he could feel how various types of escalators worked.

> Not all escalators, but -- and usually only on one side, either up or down, and it would only be at the top or the bottom, usually at the top. And I was wondering if I was crazy, so -- because the first one actually made me tingle up past my wrist and I was like, what the fuck? Thought I was imagining things, thought it was coincidental, maybe something to do with healing [from a previous injury], and then I started walking around on the strip later that night and I found three or four more escalators. And then I went home and looked at diagrams of escalators, and you have motors that move the handrails and motors that move the actual walkway.

These are but a few examples of many, and I was continually surprised at how easily grinders' found electromagnetic senses to integrate with mundane objects and tasks of their everyday lives. Magnetism was able to provide another dimension to a variety of sensations, from sounds, sights, touching and, of course, *almost* touching.

Grokking in the free world

Some objects are probed simply to see if they work or not, but other objects take on entirely new meanings depending on how they feel and in what context. In *Culture is Our Business* (1970), McLuhan argued that "one of the many flips of our time is that the electric information environment returns man to the condition of the most primitive prober and hunter"

(p. 24). With their newfound powers, grinders actively seek out new experiences by delving into an unexplored sensory realm embedded in ordinary objects. Anything with an electric motor will produce some sort of electromagnetic field, but they are not consistent or always predictable, and so each object requires its own description.

> So something like a coffee grinder, for example, has usually a really tight ball of energy which dissipates really quickly, right? Maybe you can't feel it from three inches away, but you can feel it from two and a half inches away, but when you feel it, you feel it at full force, right? And then something like a microwave has a completely different style of energy. The air – the volume may be much, much larger, but the intensity even when you get close is like – it does kind of increase as you get closer. But it doesn't have as distinct an edge to it. And so all these different energy fields, they have both strength and then whatever the – like a cell wall, right? Some of them … they're very tightly constrained, and some of them are very soft and fluffy. (Jacob)

Magnetic fields are immediately hybridized with different depths, energies, and affects, as the sensory dimensions of objects are discovered. This makes possible new relations not only between the implantee and the object, but between the objects themselves. When I asked Zac what kinds of objects were remarkable, he outlined an entire hierarchy of appliances by how they feel.

> The magnetic clasp on my laptop – because I normally will keep my laptop off the side of the bed, so sometimes if I just rest my arm over the side I'll just brush past it. And then also on the laptop, like the fan or the hard drive spinning. The blenders are really cool. Same with microwaves. I feel like blenders are nicer. What is really weird after starting this new job [at a tea shop] is we sell bags of loose-leaf tea that we'll pack and store, and then we'll have to seal. So we have a heat sealer, and I don't like the heat sealer because the field just feels like – dirty? I don't know. So every time I'll … push it down and then remove my hand, hovering over there just because I don't like being within that field. It's just, I don't know, uncomfortable

> … And I'm always looking for something new every time I encounter some new electronic device. I'll just probe around it and see how powerful it is. I think my favourite thing I've ever felt, though, was actually during when I had my first implant. So it was still super fresh, not really sensitive, but at my old job we had this trash compactor in the back of the store, and every time I would take out the trash that -- I don't know. It was just so powerful. Just walking into the vicinity, just get this buzz … I like to say it feels like you're walking toward this super powerful object, but, I mean, really you are. That is what you're feeling because there's so much electricity going through that. … It always reminded me of as if there were some mystical artefact or something that was the energies emanating from it. It is, but -- I haven't yet, but I still want to go back now that I have a fully healed one on my finger just to see what it feels like at peak sensitivity. I think that's my favourite thing.

Hearing Zac's account, I cannot help but be reminded of Pliny the Elder, as he relates his body to previously 'stubborn' objects that reflect his newfound powers back upon himself. The objects themselves take on personality ("cool," "nice"), and also act on Zac by making him uncomfortable. Moreover, the influence of electromagnetism takes on a mystical energy that was previously beyond ordinary understanding.

Electromagnetic senses can also reveal pre-existing orderings of the world that have been forgotten. In older buildings, Jacob tells me, it is possible to feel where poorly-shielded electric lines "whisper" or "leak" through the walls. "It's like if it was water there would just be stains in the wall from where the energy being drawn was kind of just oozing out of the wall there." Similarly, tragus implants can pick up public T-coil hearing aid transmissions (also called a telecoil or 'T Switch') meant for those with hearing disabilities. Rich told me about buildings that broadcast messages from long ago, "and so there are ghost messages all over certain cities with really old information on what train to take … stuff that's still being broadcasted that nobody remembered."

Magnets not only retrieve a lost history of spaces, but they can uncover the lost *present*, even if it is unclear what such experiences mean. Todd recounts entering a hotel lobby when his magnet starting vibrating. "I was like, what the fuck is going on? And it was a very interesting -

- magnets go off in the weirdest places sometimes." I asked him what he thought what it was. "I think it was like a fire alarm system. But I'm not sure why they would have EM waves posted in their lobby. Maybe it's for gun detection? I don't know. Like, that would [be my] guess. But I've never had it go off at the airport, so I don't fucking know." Jacob described a similar experience in San Francisco:

> A couple of other interesting ones around the city are all of the banking skyscrapers in the financial district have this really crisp sheet wall of tight electricity going across the front. And I guess to kind of describe that in other words, the experience that you're talking about is like a big fuzzy bubble that's kind of bubbling up from the ground. It's maybe four or five feet tall and maybe four feet wide, and it's got fuzzy edge. … It goes, like, *mmmmmmmMMMMMMM* [he demonstrates an increase in magnet 'volume' that increases as he gets closer] and it kind of leads in gently. And it has a dense centre, but it gets quieter kind of outside of that. The banking buildings, it's not like that. It's like nothing, nothing, nothing, nothing, *a hundred percent, a hundred percent*, nothing, nothing, nothing, nothing, nothing. … It feels like some sort of alarm or security system, you know? Like probably like some sort of – yeah, I don't know what it is, but it's very distinct.

Pulsing electromagnetic fields of this sort might be unintentional, but they don't happen by accident. Because there is a human-built device that causes these effects, having a magnet implant forces a person to slow down and reconsider how and why a particular state of affairs has come to be. Sometimes it is left to guessing, but other times the field's purpose is obvious, like with anti-theft security pylons in stores. These pylons have become so ubiquitous that they blend into the background of commercial experiences. With an implanted magnet, however, I received a tiny jolt every time I passed through, for example, the university library's entrance. It was a small reminder that I am under surveillance, and have likely been under surveillance of an invisible authority many other times without knowing. At the same time, I also gained the knowledge to exploit the security pylon's electromagnetic fields by sensing where it was weak or broken.

Electro-woo

Beyond stealing books from the library[25] and forming relationships with objects, the asymmetrical distribution of sensory capabilities also leads to reorganizations of social relations. Jordy half-joked that having a magnet implant represents inclusion into the grinder scene, "just because it feels more like I'm part of a cool secret club and it's like I have my own special super power – but not really." Brian told me about doing a sort of 'magnet handshake' where you bring your magnet implant just close enough to someone else's to feel the pull, but without physically touching. Craig and Deb considered getting what they called 'lovers magnets' in their palms, so that holding hands denotes attraction both figuratively and physically. Magnets thus continue the tradition set out by tattoos and body modifications by acting as an (invisible) marker of social cohesion (Demello 2011, p. 339; Favazza 2011, pp. 129-130; Lemma 2010, p. 150; Synnott 1993; Turner 2000). This sort of "cyborg culture," as Brian puts it, evokes a sense of intimacy, but it also has implications for unbalancing power relations and systems of exclusion.

To have the maximal effect, magnets need to be implanted close to nerves, but their implantedness also means they are concealed. Some grinders choose not to reveal their implant, hoping to avoid discrimination, judgments, accusations of devil worship, or other negative responses. Jordan says, "I've not told my parents about it and I don't intend to … Just because I know what their reaction will be, and it's not one that I'm inclined to deal with. My parents will just say, 'well, that was really stupid,' and won't be very interested in why I chose to do it or what it's been like." Unlike other body modifications or tattoos, the point of implants is they are largely imperceptible. Even if his magnet protrudes a little, Drew jokes that his secret is safe: "I love that I go around and nobody has any idea, and if anybody ever noticed this they'd be like, 'wow, he has cancer or something, I should be nice to him.'"

The concealment and novelty of magnets also creates options to reveal the wonders of magnet implants in fun ways. When I asked Rich to give me an example, his face lit up. "I always do bar tricks with it … in fact, it's scandalous." He proceeds to recount various grafts in such detail that he must have practised them many times. In one of my favourites, Rich sits down at the bar and strikes up the usual small talk: what's your deal, what brings you here. Then

[25] I didn't.

he lets it slip that he's in town for a psychic convention. "'Yeah, I just started with these guys and I do low level telekinetic stuff. Read minds a little bit.' But I play it down, like, 'yeah, some of the guys I work with, they can move big objects across the bar … I'm just training on this rock.'" He then pulls out a quasi-oblong-shaped hematite rock and begins to punctiliously manipulate it (feigning much consternation) with the magnets implanted in each of his hands. "But I just make it move a little bit so I don't go overboard on it, so that it *just* turns it."

This behaviour is not unique to Rich; many grinders have applied their skills to confuse others, win free beer, or garner the affections of attractive bar patrons. They become, true to their *Doktor Sleepless* roots, *tricknologists*. "It's fun to be able to just move things, where it doesn't look like you should be able to move things … People are just like, 'how?' and, 'magic!'" (Craig). Magnets also afford deviant opportunities to pass the time by exploiting asymmetrical sensibilities. When Ron is bored at work meetings, he turns to distracting others.

> My little magnets I play with at work, like standing them up or just … flick a finger, it'll jump up and stick to my finger, and then you'll peel it off and set it down and flick again and it'll jump. And one of my favourite things to do with it is just do that or stand up and roll it around while paying attention to the meeting. So watch the presentation, look up at the screen, don't look at the magnet. And out of the corner of my eye I can see people staring at it. Like, mouth open, like "what's going on?" And you don't acknowledge them. After a little bit you just sort of pick the magnet up and flip it to the back of your finger and you just cross your arms or something and just pay attention to the meeting. And even after the meeting you walk out and you say goodbye to them or whatever and you can see -- you can just tell it's bothering them. You know it's eating at them because they really need to know. They don't know. But they're not going to ask you, 'what? how?' because it makes no sense. […] Sometimes people are like, how are you doing that? I'm just like, 'oh, it's magic.' Magic trick. I just give them a magnet and am like, 'here, just practise. You'll get it someday.'

Since an electromagnetic sense only interacts with nearby objects, and, more importantly, because only the person with an implanted magnet will 'react' by the ensuing sensory networks,

I suggest there is a strong argument to be made that the electromagnetic sense is firmly interiorized in the grinder's body. Indeed, despite the appeal of a magnet implant's superhuman abilities, they eventually tend to become quite ordinary in the day-to-day lives of grinders. Eventually the slight tug of a finger towards the metal patio table feels normal, and it no longer registers consciously. Not only do the sensations blend into a broader sensorium, avoiding sensitive strikes to magnets become habitual. After a while, implantees adjust to any discomfort by changing handwriting technique or how to hold a guitar, depending on their placement. If put in the wrong position, a magnet will trigger MacBook laptops to shut off, but after some time passes it becomes instinctual to avoid these minor annoyances.

Beyond reflexive behaviours, there are also strategies to avoid painful experiences by taping up fingers before moving heavy objects, or simply keeping a safe distance from, for example, a MIG welder. Out of sight, the magnet becomes largely out of mind. After years of having them, Jacob says his "every day usage is practically non-existent." For a period of time Berkelley forget she had magnets at all. Despite his expectations, Evan seemed almost underwhelmed by his experience, reflecting how "… the most surprising thing about the whole process is … how regular it's all been. There's nothing really super dramatic, which I was kind of expecting either to get into a debate with somebody or to have these insane sensations from my hand. And it's really all just kind of integrated right in." For Rich and Jacob, magnets became so integrated into their everyday experiences that they have even 'used' their magnetic powers in their dreams.

Fatal attraction

About four months after my implantation, I also had a dream about my magnet. Unlike Rich's or Jacob's dreams, however, in mine the magnet had lost its power and my finger had painfully swelled to twice the size. This, too, is not an uncommon feeling in waking life, as the notion of a breach or rejection can weigh on one's mind. As Rich has frequently reminded me, no implant will last forever, and you should have a plan to take it out if (and too frequently when) the biocompatible coating fails due to an imperfection or accident. In fortunate cases, a rejecting magnet will slowly find its own way out of the body. For some, like Gabe, it is an unproblematic process that sorts itself out: "I can see more and more gold every day, and then it started poking through, so I ended up getting another magnet [to hold next to it] and just kind of

popped it right out." Others are less fortunate, and when the area becomes red, swollen, and painful, it must be cut out. This can be trickier than expected. Jeff once had to remove someone's magnet that had become wedged underneath a tendon (it had been implanted by someone else). In contrast, when Matt tried to remove his own magnet there was one small problem: "I couldn't find it. […] I got to the point where I thought the tip of my scalpel was scraping the magnet, but when I peeled it open it wasn't there."

Unlike getting a magnet implanted, doctors seem to be slightly more willing to help with extraction. For Ben, as usual, this involved phoning around to find a willing accomplice. Several Instacare clinics refused him because it was perceived as a 'self-inflicted' issue. The medical professional who ended up removing his magnet not only required a special consent form waiving liability and a tetanus shot, but also insisted Ben prove there was actually a magnet by holding other magnets up to the skin to see them 'pull' on each other. (There was also something of an ulterior motive for this particular medical professional, who during the procedure confessed he was an amateur magician whose illusions could benefit from a magnet). The magnet was "black and nasty," as Ben describes it, and already half eroded by the time it came out.

Since the experience of having a magnet becomes so normal, it is unsurprising that losing electromagnetic powers evokes strong emotions. After the pan incident, Justin A described his sense of loss "like you've gone blind -- which is not something that you can really articulate well. But you totally understand what going blind is like because you go expecting a sense and there's nothing there. [...] So as soon as it's gone, it's like -- where the fuck?" Despite the fact that months had passed since Stephen's two magnets rejected, his grief was palpable. "I still miss them. I was actually pretty distraught for like a week after my ring finger one came out. I had kind of a little more advanced warning that the thumb was going to come out, and I had already dealt with the ring finger coming out so I wasn't as upset other than the fact that I then had no magnets at all." According to multiple accounts, even after losing a magnet, the tendency to reach out to familiar electromagnetic objects remains deeply engrained in the techniques of the body's habit (Mausse 2007, pp. 50-53).

The interiorization of a magnetic sense, from conception to extraction, emphasizes slowing down. For those developing and experimenting with bioproof magnets, there is testing through implanting, waiting, and re-implanting various designs. Most significantly, once healed,

it impels a person to slow down and explore how the electromagnetism can animate previously docile objects and enact new socio-material sensory networks. The process of losing a magnet only further emphasizes how interiorized the sense had become. But as much as there is to discover with a magnetic sense, there is no established sensory infrastructure for magnetic senses like there are for more common senses. Grinders take this lacuna as an opportunity, but it is one that challenges the social pace of their electromagnetic interiority.

PART II: EXTERIORIZATION

> *The division of faculties which results from the technological dilation or externalization of one or another sense is so pervasive a feature of the past century that today we have become conscious, for the first time in history, of how these mutations of culture are initiated. Those who experience the first onset of a new technology, whether it be alphabet or radio, respond most emphatically because the new sense ratios set up at once by the technological dilation of eye or ear, present men with a surprising new world, which evokes a vigorous new "closure," or novel pattern of interplay, among all of the senses together. But the initial shock gradually dissipates as the entire community absorbs the new habit of perception into all of its areas of work and association. But the real revolution is in this later and prolonged phase of "adjustment" of all personal and social life to the new model of perception set up by the new technology.*
> McLuhan 1962 (pp. 22-23).

Magnet implants provide an interiorized sense. And while there are plenty of objects emitting magnetic fields to discover, the world isn't made *for* them. There are no magnetic gardens, or restaurants where you can order a tasty electromagnetic field. There are no cars that will warn your magnet implant of approaching obstacles (although Nissan has funded research in this area, Harrison 2014). And electromagnetic senses are not yet prevalent enough to be coopted or exploited by marketing firms, like what has happened with haptic sensory devices (Paterson 2005). As a simple implant, the sensory networks of magnets by themselves are essentially limited to the examples enumerated above. However, a number of grinders have

taken to building an infrastructure for magnets that can take advantage of a magnet implant's unique depth.

In fact, one of the first things grinders did with their magnet implants is try to exteriorize them through peripheral devices. Whereas an interiorized magnet implant provides access to any electromagnetic fields, these exteriorization devices render this access contingent on decisions about what should be sensed, how, and by whom. What can these decisions tell us about the sociality of grinders, and what are the broader implications for electronically mediating senses? In this section I discuss the peripherals, both realized and in development, that redistribute sense ratios.

Rich's tragus implants: Discovering creations

Magnet implants alone sense magnetic fields, but they can also be used as stand-ins to experiment with other sensory assemblages. Since a magnet implanted in the tragus (near the ear canal) can vibrate at audible frequencies, it is an ideal location to exploit by stimulation via electromagnetic induction. In 2013, Rich Lee came up with this idea after being told he was going blind, and so he proactively looked for some way to perceptually compensate. In his search, he came across a device on E-Bay that marketed itself as a tool for cheating on tests. The device was a simple induction coil[26] worn like a necklace, which vibrates magnets dropped in the ear canal.[27] By plugging the coil into an MP3 player, it was possible to listen to an audio recording with all of the test's answers, broadcast not through air pressure but through the electromagnetic waves. The problem was the magnets would easily fall out of the ear.[28] Rich

[26] Normally, a common audio speaker works by feeding an electric signal into an induction coil, which in turn is attached to a magnetic speaker cone. The cone vibrates, causing changes in air pressure picked up by the naked ear. The induction coil/tragus magnet implant, however, does not operate as much by air pressure as by vibrations inside the body, which are nonetheless picked up by the eardrum. In other words, instead of vibrating a magnet in a speaker cone, it vibrates the magnet in the tragus.

[27] A magnet implanted in a finger would also work, though it requires sticking the finger in the ear.

[28] Rich also recounted an anecdote he'd heard of another problem with using this device for cheating. Someone had recorded a speech they were supposed to memorize for recitation in front of a class. However, microphones also operate using magnets to receive vibrations (they work essentially the same as a speaker, but in reverse), and so the microphone picked up the induction coil's transmission and broadcast everything before the orator had a chance to open their mouth.

decided to implant the magnets after noticing that running his finger across the tragus had a "stethoscope" quality that may better conduct sound to the eardrum. Though ultimately Rich did not end up losing his sight, he is still working on a building an echolocation device that would facilitate navigation for the blind via tragus magnets.

Tragus magnet implants require an external device to be effective, which opens up possibilities for the modulating the public/private properties of sensory information. For example, when attached to his cell phone, Rich's induction coil and magnet assemblage form a covert listening device that does not otherwise impede his hearing. This set-up not only renders the sensory data private; it also renders invisible that anything is being listened to at all since it does not require conspicuous headphones. With a 'text to speech' app, Rich can listen to books or webpages while driving while his passengers are left unaware. Taking this idea one step further, Rich has tested connecting the induction coil to a contact microphone. Unlike typical microphones which pick up changes in air pressure, contact microphones pick up vibrations through contact with solid objects, making it easier to listen to conversations through walls or doors.

Rich's induction coils paired with tragus implants manifest a sort of *electro-synesthesia*, which complicates the relationship between interiorization and exteriorization. Magnets are an interiorized sense, but the application of peripheral devices exteriorizes them by inserting a mediator between sensory acts. Instead of an object producing an electromagnetic wave that acts on a magnet implant as an intermediary of those waves, there is now an object acting on a device that further acts on the magnet implant. In the latter scenario, the intermediation is now preceded by a mediation. The possibility of 'stacking' mediations and intermediations will become key in the following chapters for understanding how sensory modification alters the depth of socio-material relations as it redistributes sensory enactments. Simply put, it makes it possible to decide what is worth sensing, and then design *who* senses *what*.

Peripheral pre-implant playgrounds

Since designing something for implantation is a time and resource intensive process, peripheral devices are useful as testing grounds for future subdermal devices. Once something is implanted it is *always* in the body, so testing new senses outside the body helps one decide if any given object is worth sensing. For example, Rich has experimented with attaching the induction

coil to a metal detector. This gives him a temporary impression of what it'd be like to be "constantly going around looking for precious metals … because all you have to do is find one gold ring or something like that and it's probably paid for itself." Likewise, by attaching the coil to a thermal detector he is able to convert distant temperatures into a hissing noise through an Arduino computer. Being able to sense if a temperature is abnormal helps identify when things are "just *off,*" as Rich puts it, such as the heat signature of a person suffering from a fever. If the results are annoying or not paying off, he can forego pursing the project any further. At this point, he tells me the technology isn't advanced enough to implant something like a metal detector in his leg, but it is something he intends to revisit.

Because it is relatively easy to hook up different peripheral sensors to his induction coil, it is possible to try senses that perhaps hold lower expectations, like a Geiger counter. When initially recounting his experience, Rich described it as "kind of boring, because there's surprisingly little that is radioactive." In his house, he found the wallboards were slightly radioactive ("They'll put off an alpha particle every 45 seconds or something like that."). I asked him if he knew where the wood came from, prompting Rich to tentatively guess the nearby Nevada test site, which is where the United States tested nuclear bomb technology in the 1950s. He then continued:

> But I know that this whole area, for a long time everyone said, 'Yeah, don't eat the local fruit in St. George' because we had all this fallout here from the test sites back in the fifties. They called everyone here 'the down-winders,' you know. There's old videos, like old public service announcement videos about 'These are the citizens of St. George. They know that when they hear this sound it's time to go indoors because the radiation levels are too high.' And, yeah, so this area was a nuclear hell-scape I guess for a while, but people still lived here [laughs]. So I don't know if the wood that was grown here had some of this nuclear crap in it or not, but, yeah, that's something I found out that was interesting. And I mean, we're talking about super faint levels that are completely safe. But I was still pretty surprised by it.

The way Rich recounted this story, from his boredom to surprise, demonstrates to me what is interesting about radioactivity is, in fact, its rarity. Taking out a regular Geiger meter requires active thought and directed attention, but an implanted Geiger meter is constantly open to serendipitous findings, even when a person isn't thinking about it at all.

About a month after Rich's interview I happened to visit the National Atomic Testing Museum nearby in Las Vegas. Notably absent from the exhibits was anything about the long-term effects of nuclear weapons, aside from the difficulties of nuclear waste storage and a brief celebration of the treatment facilities built by the United States in Japan. Even if Rich's radioactive wallboards aren't from the Nevada test site, they nonetheless point toward a past that has become lost, yet nonetheless continues to have consequences – a past that would be recovered if there were sensors continuously probing for somewhere to start looking.

Grindhouse's *Bottlenose*: Creating discoveries

In Rich's applications for the induction coil, most involved using electronics extending his ability to *actively* search for new experiences, or forms of information, by exploring out in the world. In contrast, Grindhouse Wetware (GHWW) has been developing a product called the *Bottlenose,* which is designed as a modular system connecting various sensors to a device on (for example) a glove, which in turn emits an electromagnetic field to a finger magnet. With the exception of the target magnet (tragus vs. finger), it is functionally nearly identical to Rich's induction coil. However, the way Grindhouse envisions its application emphasizes an experience where information is instead drawn towards a more *passive* user.

The Bottlenose is one of Grindhouse's longest running projects, existing even before Grindhouse had a name. The original prototype built by Tim Cannon and Shawn Sarver has since undergone several transformations by the GHW team, ranging from commercially available Arduino-based circuitry to soon developing custom printed circuit boards. Each transformation brought its own challenges, based on new program programming languages, sensors, and "lower level, easy stuff electronics that you don't really think about until you actually start working with it" (Jes). Justin W admits that early versions amounted to little more than "a neat gimmick," but its potential seemed clear to everyone working on the project. Even

Marc readily acknowledges "it wasn't terribly new, the technology wasn't terribly new, [but] the applications were new, and I think that's what made people really aware."[29]

Sensors readily available for the Bottlenose can measure distance, light, blood alcohol content, and touch (though the accuracy of some could use refining), though anything that can be measured can conceivably be digitally mediated into an electromagnetic pulse. One challenge for GHW is finding ways for the range of expression to be mapped from the sensor to something practical for the user. Jes described how the trial and error process has "basically just been heuristic. Tweaking the numbers, seeing how that feels, then we move around, okay, tweak this a little bit, tweak this a little bit more. It's just sort of exploring, really. There really is no baseline to work with, so we're trying to find that. It's going to vary from person to person." Jes's description highlights how the exploration for new senses now takes place in the terrain of the device itself. 'Exploring' in the device takes the form of decisions about what is worth sensing and how, or, in other words, what to render sensible and insensible.

Take, for example, a novel application of transmitting messages into a magnet. Grindhouse began with simple Morse code as a mediator. After brief training on deciphering numbers, the Grindhouse team moved on to testing playing card values. Ryan would select a card from a deck and transmit its suit and value through his phone, across the room into the bottlenose. The player would then sense the answer, unbeknownst to any unmagnetized players. Through practice, they told me, it becomes less about interpretation and more an intuitive response.

But the messages needn't remain so simple. Just as the telegraph eventually gave way to telephone, Marlo explains to me there is no reason to limit oneself to on/off signals like Morse code:

> So instead of just having pull [or] no pull, you can have pulses, then you can have faster and slow pulses as one dimension of sensation, and that feels a certain way. Then you can alter the duty cycle […]. So the magnet can be turned on for a longer amount of time or off for a shorter amount of time. So it could be on for ten more [milli]seconds, off for 90, or on for 90, off for ten. And that changes the sensation,

[29] The bottlenose is reminiscent of Gault's 'mechanical ear' experiments of the 1920s (see Parisi 2018).

> too. You can alter the waveform, so it could be a sinusoid, it could be square, it could be a triangle. That feels different. They all feel different. And then by combining these things you can have -- as well as different strengths, different textures, different, you know -- some things can feel like a buzz, some things can feel sharp, tingly. I mean, it's obviously effected a lot by things like the tissue and the fact that it's a chunk of metal vibrating in your fingers. So you couldn't ever make things feel smooth and slippery, but you can have different tingles, buzzes, zaps and pings and all this stuff. And it can be used to convey information if you know what you're doing.

There are also biological limits, he reminds me, adding how "You could have the [Bottlenose] magnet tug on your magnet so hard it literally does damage. You'd need a pretty strong electromagnet, but such things exist."

The 'enhanced Morse code' itself, however, is not limited to playing cards or words. Justin W envisions "a certain Morse code combination of everything … and so all you have to do is hold your hand next to your pocket and the information in the background eventually just becomes background noise to you, but you're still getting the info so you don't have to be constantly looking at your phone or your watch or anything." Grindhouse members provided many examples, such as weather forecasts, Twitter updates, and phone notifications, which would all become corporeal experiences. By crafting a computer script to analyze social media alongside geolocation data, something like the Bottlenose can relay information to avoid approaching traffic congestion, or nearby critical events like ambulance or police dispatches.

Much like modern haptic devices, the appeal of the Bottlenose (and what it represents for future devices) is its promise of desubjectification – that is, its potential "to enable the emergence of a new and free subject" that reacts instinctually rather than unnaturally (Parisi 2018, p. 321). But as Parisi (2018) points out, such a process belies the political undertones of how the device itself has emerged historically, while at the same time producing a "fetishistic celebration" (p. 321) of the device's ability to, in a sense, 'replace' reality.

Re-placing space

With a Bottlenose, the user *sets* the patterns of everyday life they want to experience, which involves rethinking what spaces ought to be imminent to the body. A Bottlenose is not

really about a magnetic sense; rather, it stands in for all the things grinders wish their bodies could sense, but cannot. Unlike Rich, who applied his induction coil device for using his magnet implant out in the world, Grindhouse tends to talk about making the Bottlenose into a device versatile enough to bring the world into the magnet implant.

It is interesting to note that the Bottlenose applications grinders (including those outside of Grindhouse) were most excited for centred around efficiency and optimization, such as calculating odds, traffic, receiving messages. These are the same characteristics of an accelerated society discussed in chapter 5, which suggests that grinders are interiorizing the effects of late capitalism – the body becomes the vehicle for pursuing maximized temporal productivity (the *now*) by reorganizing space (bringing everything *here*). Just as McLuhan described the printing press as rearranging the aural and visual organization of knowledge, grinders are (at least attempting to) reorganizing themselves according to the logics of instantaneous computation. Grindhouse members theorize that if information can be abstracted into the digital realm then it can be transformed into an electronic intuition, and if these intuitions can be felt continuously then patterns would begin to emerge that could increase efficiency. A person can already calculate odds, sense traffic, and receive messages, but the Bottlenose makes these happen *faster* by exteriorizing the computational work.

Another of Grindhouse's implantable devices, the *Circadia*, aims to extends this efficiency to the body itself by capturing biometric data (e.g. temperature, pulse rate) and then transmitting information about biorhythmic deviations in health to a smart phone, which could further be connected to a Bottlenose[30]. With enough data for analysis, Grindhouse expects it will be able to predict ailments, such as a rising temperature indicating an upcoming illness. Essentially, it enacts what Kroker (2014) theorized as an "electronic nervous system" existing alongside a biological nervous system, which opens up biopolitical intervention that prioritizes code over cells (p. 8). Since a Circadia/Bottlenose combination will provide ostensibly objective feedback, the data itself will become the primary target for efficiently attaining a healthy body.

[30] A prototype of Circadia was implanted in Tim Cannon for a short period of time, during which it produced useable data from a temperature sensor, a couple of LEDs, and the ability to connect to a phone. Currently in development, the next version of Circadia will be smaller and have increased sensory capacities. Ian is hoping it will include temperature, pulse rate, blood pressure, blood oxygen, and if possible, blood glucose and general spectroscopy.

Peripheral devices, therefore, cause the user to act, but the devices are programmed to collapse a particular kind of space into the imminent sensorium in a predetermined way. They make new data accessible to the senses, but the form of the data is decided ahead of time, not only in what to 'look' for, but how it will 'feel,' and how it will be overlaid on existing senses. Moreover, these decisions can only be made by those with the skills to (re)program these parameters, leaving everyone else to adapt to its predetermined sensibility. The user's sensory entanglements are therefore mediated at least twice before becoming sensible – first in how the device is set up by the author/programmer, and second when the device itself does the sensing before relaying it to the body.

Where do magnetic implants point?

Magnetic implants have much to tell us about grinders and the potential for other sensory modification. Though it may not be a comfortable procedure, it is, after all, only a small cut. As Justin A puts it, "That's why I love the magnet, because that's a quick hardware thing, brand new sense, very little effort, and it can come back out if you're not happy with it." Marlo was also satisfied with the overall results both practically and theoretically, concluding "it proved that you can totally add new senses into people. The brain's plasticity takes care of all the wiring things up. All you have to do is put the hardware in. Your brain will figure out the rest." Justin W and Marlo's summations of their magnetic experiences point to the paramountcy of scientific description frequently espoused by grinders, in this instance focusing on the relationship between the magnet and the brain.

However, such a Maxwellian perspective elides how this relationship is complicated by the body itself and its social circumstance. Electromagnetic senses may be new, but the sensory networks they enact are entangled with existing networks, like library surveillance, the remnants of a nuclear testing program, and the medical system. The body is always acting, and nowhere is this clearer than Justin A losing his magnet in an accident with a pan, or Marlo's magnet rusting in his finger. A magnet is implanted mere millimetres below the surface of the skin, and with this distance comes a plethora of socio-material considerations that affect where, for whom, how, and even if a magnet implant will work. Anatomies, lifestyle choices, and late capitalism all come into play.

That said, with all of the preparation and work required to get a magnet a few millimetres

under the skin, its sensory extension a few millimetres *beyond* the skin are where socio-material conditions are significantly reconfigured. It animates electrical objects and can retrieve lost histories, hidden presents, and invisible methods of surveillance. A magnetic implant impels a person to slow down, first through the implantation and healing process, and then when exploring the electromagnetic world to give stale affairs a fresh look. Yet as much as it uncovers a new world of wu, the existence of asymmetrical sensory abilities also opens up exploitations of woo by creating naïve populations without any direct access.

At the Tehachapi lab, I can recall one incident of a documentary crew member that had been hanging around for a couple of days with a group of grinders. They had been teasing her by pretending they could sense things with their magnets, getting increasingly preposterous until she finally caught on they were being deceptive – they were engaging in *mesmerism*. It got to the point that she was suspicious of everything they said, and even turned down the offer of a cookie for fear it might not be what was put forward. She could no longer trust them. In this chapter, much has been made about the physical and mystical properties of a magnet's attraction, but largely absent from the history of magnets and grinders' practices is an acknowledgement that magnets also *repulse*. The consequences of magnet implants may or may not seem trivial, yet they illustrate how the asymmetrical power relations of subdermal sensory devices facilitate social exclusion. The range of a magnet is close enough to signal group membership between implantees, and also inconspicuous enough to keep hidden when so desired, keeping others unaware. As such, it is a relatively interiorized, private sense, but one with broader implications at least for other implantable devices.

Making an interiorized magnetic sense has taken a tremendous amount of work, which pays off in a newfound sense of exploration and discovery. Once the magnetic sense is externalized by peripheral devices, however, it immediately becomes a stand-in for any other phenomena that grinders want to feel, so long as it can be reduced to an electromagnetic pulse. This can be done in a way where the body is active (that is, it has to get up and move around) to find this information, but it also has the option of remaining passive (that is, it can sit down and have information come to it). In the latter case, however, there is less chance of discovering new things by happenstance, since choosing modules and programming requires deciding what to find and how it should feel ahead of time. Both active and passive external devices reduce, as McLuhan (1962) worried, sensory "interplay among experiences" (p. 265) when sensibility is

pre-determined. Moreover, like clocks, these devices obscure the algorithms and decisions made by designers for anyone not technologically savvy enough to modify it themselves. In this way, the architects of peripheral devices are also the architects of experience by deciding not only *what* acts, but also *how*. Here, mesmerism takes place outside the user, who is nonetheless phenomenologically affected.

Chapter Seven
RFID Cyb/organs:
Distributed Memory, Identification, and the User-friendly Implant

> '*Oh, it's a foreign object in my body*.' Yeah, but so is every bite of food you chew until it becomes a part of you, and the same is true for an implant, right?
>
> Amal Graafstra

> If something is to stay in memory, it must be burned in: only that which never ceases to hurt stays in the memory – this is the main cause of the oldest (unhappily also the most enduring) psychology on earth.
>
> Nietzsche, On the Genealogy of Morals.

Over a pitcher of beer on a Salt Lake City patio, Stephen is recalling his memories of being a grinder in what is historically one of the most conservative of United States. Stephen has an invariably calm, deep voice – the sort of voice you'd want to talk a grizzly bear out of attacking – which makes his extraordinary stories sound almost nonchalant. "One was right over there," he begins telling me, pointing at a semi-obscured booth in the corner,

> this guy came in and was convinced -- *convinced* -- that his sister had sent men out to get him and abducted him, and they implanted an electrode in through his head down the side of his nose and then some into his bowels, and that basically his sister could remotely make him piss and shit himself, or control his thoughts. And I stayed quiet; I was sitting in the corner. And there was this other dude who had been fucking pistol-whipped in the head and part of his skull is caved in so his brain doesn't even quite work right, and he's like, 'Dude, no. No. Take control for your actions. You pissed and shit yourself on your own. You do not have electrodes in your body.' [The first guy was] like, 'No, I do, I do.' And I'm sitting there giggling because it's right as the thread is active on the [biohack.me] forums about making subdermal electrodes, which is actually what [another grinder] is working on.

This story speaks to a sort of techno-paranoia that orbits assimilations of technology and bodies, which stems from competing assertions of authority on identifying what is, can, or should be happening. Grinders may largely keep to themselves, but they inevitably bump into competing ideological claims about the relationship between bodies and technology.

The Mormon-dense Salt Lake City is a perfect case in point. Accounts of techno-paranoia (justified or not) are not unique to Salt Lake City, though it does have a history of producing intense cultural reactions to systems of authority and control as evidenced by its renowned straightedge punk movement (Foster 2001; Smith 2011). It is perhaps unsurprising, then, that it's also become a small but noteworthy node for grinding. Having been raised Mormon and later rejected it, Stephen and other Utahan grinders explained to me how both their state and the reactions to it are influenced by Mormon doctrinal tensions between pursuing human transcendence towards godliness, yet at the same time forbidding all but the most minor forms of body modification. I think some expressions of grinding can almost reconcile these seemingly incompatible planes: the capabilities of the body are increased, while its form is minimally altered by subdermal implants. Though it's not always as pronounced as in Utah, this confrontation between preconceived notions, idealized expectations, and material realities is one routinely faced by grinders' interactions with those outside their cultural milieu.

As the supposedly unwilling implantee from Stephen's story demonstrates, the idea of subsuming foreign objects into the body challenges conceptions of body autonomy by forcing previously discrete planes to collide in what I will call a controversy of security. It is a dispute about the identification of bodies, which I contend has a lot to do with how the socio-materiality of skin places it at the centre of contradictory enactments. Informed by both cultural and psychoanalytical theories, Lafrance (2009, 2018) explains how the skin has long been an important cultural marker of identity because its physical and mental boundaries are mutually contingent. Moreover, skin is both the means *and object* of perception (Howes 2018), rendering it semiotically contingent on the individual and society, a continual reinvention (Conner 2004). Grinding cannot help but upset these boundaries when implanting subdermal devices. That bodies already interact with electronic and digital objects is uncontroversial, given the pervasiveness of cellular telephones, bank machines, and Internet-of-Things devices in everyday

life. So what difference does it make when grinders' devices, and in particular electronic devices, are under the skin?

I suggest the ideal case study for such an inquiry is implantable Radio Frequency Identification (RFID) transponders (or 'tags') for several reasons. First, their use is relatively popular, which has produced a variety of accounts. Second, unlike other grinder devices whose functionality requires being under the skin (e.g. measuring biomedical data, or stimulating nerve cells with a vibrating magnet), technically, an RFID works exactly the same inside the body as it does outside. That an RFID is not worn or even glued to the skin indicates that the implanting itself is of some significance. Third, the very fact that RFID is a chip designed for purposes of *identification* helps bring to the forefront how something below the skin enacts a different kind of identification than outside the skin. In this chapter, I explicate the crisis of security by taking the skin as the fulcrum in a balance between competing enactments of identification. When adopting digital technologies into the body, it is necessary to consider how their processes of identification act as sensory extensions.

Before proceeding, a short point of clarification is in order. The term 'identity' in social sciences is a complex concept whose meaning varies by theoretical and contextual position, whether it be a personal identity (e.g. ego, selfhood), a social identity (e.g. class), cultural identity (e.g. straight-edge punk), and so on. I am not as interested in specific forms of identity as the process of identification that makes identity sensible. Recall in chapters one and two how grinders conceived of 'hot-swapping' genitals or changing skin colour to undermine identities related to gender or race by making them insensible. Yet with RFIDs, they are implanting a device explicitly centred around the process of identification. Thus, rather than focusing on identity, I am instead using the term 'identification' (both as a verb and a noun) to refer to the sensory networks that act (or attempt to act) through processes such as detection, recognition, or verification that bring together a particular set of relations. Identification is a process of verifying some ontological stability by making it sensible. In Stephen's opening story this was not possible, leading to a dispute. As this chapter will demonstrate, achieving mutual identification between bodies and RFIDs also instigates numerous disputes. To be clear, my working definition of identification is still caught up in broader questions of identity, and the boundaries between physical and mental are very much at play – especially in the narratives of

my informants. Nonetheless, the present inquiry is limited to the particular enactments of identification related to RFID implants.

RFIDs, keys, and memories

'RFID' refers to any technology using radio frequency energy, and as such the term applies to a wide range of devices. Most people are somewhat familiar with the RFID transponders concealed in their passports or implanted in pets, which are quite small. How RFID technology works can be highly technical, but I will focus on only a few properties that are pertinent to the question at hand. First, all the RFID tags this chapter is concerned with are passive, meaning they have no battery. Rather, they are powered by fluctuating radio waves that act on the transponder's internal inductor, causing the tag to alter the radio frequency field in a detectable way by a reader. In other words, there is a secondary device that emits radio frequencies and inductive power to an RFID transponder, as well as detects how that transponder affects the radio wave field. To simplify by way of analogy, it's like yelling into a canyon and hearing the unique corresponding echo – the canyon just has to 'be there' in the shape it is; all of the 'work' is done by the yeller and listener. Because there is no battery, passive RFID systems only work within a short range (typically 10 cm to 1 m, or less, depending on power and interference). For example, this mechanism is how anti-theft alarm pylons work in stores or libraries. Second, for the tag/reader assemblage to function, the tag must be compatible with both the frequency and protocol of the transmitter. This is why it is (usually) possible to take a recently loaned library book through the security pylons at Walmart without setting off the alarm.

An RFID tag is, essentially, a key. Each individual tag features a unique signal, just like a traditional key features a unique tooth pattern. Broadly speaking, keys are required to cross secured boundaries, which signifies there is likely something that has value because it is intentionally embedded in an infrastructure that renders it inaccessible. From this perspective, a key displaces value – e.g. the value of the locked, heavy treasure chest is now entirely in the lightweight key. It can lock things in or lock things out.

Keys themselves can, of course, be locked up to further displace value, and that is exactly what implanting an RFID does. The boundary of the skin acts as a sort of lock, and one thing it displaces is memory. A memory can be conceived as an sensory image, but that image is not

stable; it is subject to change and forgetfulness (Williams 2011). However, once the RFID is inside the body, the implantee at least no longer has to remember where they left their key – it is impossible to forget to take it along, plus it cannot be physically taken by a thief (without the key: a scalpel, perhaps). It is a way of distributing memory, exteriorized from the body, and immediately interiorized under the skin somewhere else. One small part of the identification process becomes streamlined and more secure. Like skin, the concept of memory is also associated with identity. Memory provides temporal continuity about the self through continual identification, even if the memory image itself is unstable and contingent upon a narrative context (Melucci 1996; Ricoeur 1991; Taylor 1989). On an abstract level, the security of the RFID memory depends on the security of the skin, but the security of the skin must be compromised to attain this. On an empirical level, as this chapter intends to put forward, this is manifested in localized controversies over which continuity should prevail: the identification of the skin, or the identification of the memory? And more specifically, what sorts of memories are worth upsetting this balance?

One immediate threat to any intention of maintaining continuity is the technological variability of RFID systems. RFID tags are manufactured to specific standards and protocols that ensure the key and the lock work together. The transponders vary by protocol, memory capacity, and the ability to rewrite or merely 'write.' Of the multitude of protocols[31], one of the most popular standards is NFC (Near Field Communication, operating at 13.56MHz), which ensures that the transponder can work with devices that are NFC compliant (e.g. certain smart phones). NFC is commonly used in some employee pass-cards to unlock doors. Each tag has a unique ID which is set by the manufacturer, and the ID is then programmed into the door's lock. If, say, an employee quits or loses their pass-card, the lock can be reprogrammed to no longer accept that unique ID, rendering the card useless. Furthermore, some tags allow users to reprogram the ID, and a cloning device can read and then copy a new unique identifier to it –

[31] Low frequency RFID (30 KHz to 300 KHz) may be operated under ISO 14223, and ISO/IEC 18000-2 protocols. High frequency RFID (3 to 30 MHz) includes options for ISO 15693 ECMA-340 and ISO/IEC 18092, ISO/IEC 14443 A, ISO/IEC 14443, or JIS X 6319-4 protocol. Ultra-high frequency RFID (300 MHz to 3 GHz) is regulated by a single global standard, ECPglobal Gen2 (ISO 18000-63). In theory, someone could develop their own protocol, though such a possibility was never brought up during my fieldwork.

even when it is under the skin. Similarly, it is possible to program many Android devices to perform any number of functions by scanning an RFID, like unlocking the main screen, or transmit contact information to someone else's phone (the "cyborg calling card," to use Stephen's term) if it is compatible. Since both the RFID transponder and its paired device have potential to be reprogrammed, dealing with RFID tags is not as straightforward as traditional locks and keys because each component intentionally has a degree of variability.

But is it a grind?

I must admit that as an ethnographer of grinding interested in sensory modification, my enthusiasm for RFID implants was initially low. I thought, perhaps small-mindedly, they were clever devices that amounted to little more than a management strategy to prevent locking yourself out of the house. The idea of distributed memory is interesting, but in a way it is also as old as cave paintings and as banal as a grocery list. And though implanting RFID transponders is one of the most common upgrades among grinders, their application reaches well beyond the boundaries of the grinder scene (e.g. Astor 2017). However, three things changed my mind.

First, extant literature identifies an anxiety about implanted RFIDs in humans, but it provides little in the way of localized explanation. Beyond the clinical, uncritical literature that delineates their application and technical capabilities (e.g. Masters & Michael 2005; Troyk 1999), it tends to focus only on hypothetical bioethical and legal perspectives on issues of privacy and tracking (Foster & Jaeger 2008; Kelly & Erickson 2005; Koops 2009; Levine et al 2007; Lockton & Rosenberg 2006; Michael & Michael 2010; Rotter, Daskala & Compano 2008). Interestingly, these bioethical concerns about implants are largely undifferentiated from literature on RFIDs that *aren't* implanted (e.g. Boeck et al 2011; Spiekermann 2009). Moreover, other than singular accounts from the developers' own localized experiences (e.g. Graafstra 2007; Michael & Michael 2010; Warwick 2010) and surveys about whether the general public would or wouldn't get an RFID implant (Hilz, Han & Briller 2003; Perakslis & Wolk 2005), there is little information about its cultural significance for the body, breaching the skin, or day-to-day experiences of being implanted.

Second, and relatedly, grinders' accounts of having implanted RFID tags explicitly described them as bound to a sense of identity. In Zac's story, his RFID is just as much a new

part of him as a magnet or any other sense would be. About a year after implanting an RFID tag that would open his car door …

> … I was getting off work and I walked out of the parking lot, went to open my car and nothing happened. It was super uncomfortable, and I was super worried because at first I didn't fully understand what I was feeling. You put your hand to your car and the car opens up and that's just what happens. And when you do that you do something with your body and you don't get the result that you're accustomed to getting it feels like part of your body's not working because part of your body is not working. It was super uncomfortable, but at the same time, again, super cool *that* it was uncomfortable, the fact that I realized that my brain had adopted that so much as my own that when it wasn't working I felt like, 'Oh my god, I'm dying, why isn't this working?' That was a real prominent moment I feel, for me, in my adaption. And even so whenever I borrow my friend's car I'll walk up to their car and tap my hand against the window and it doesn't work, and I'm just kind of confused at first. […] The magnets, I expected going into it that I would get that sort of adaptation or immersion where I just kind of accept that information as my own, and not external. But for some reason I didn't really think that would happen or even think about the possibility of it happening with NFC tags or RFID tags. But it makes sense in hindsight because you're adding a new feature to your body. I'm assuming it's probably the same thing that happens to someone who maybe receives brain damage and forgets how to do a skill that they've done their whole life.

If proprioception is a sense of where your limbs are relative to each other, then Zac's account suggests that identity might be thought of as a sense of an orientation in relation to a network of identification. For Zac, opening his car helps identify not only the car itself, but also the integrity and integration of his modified body. When the identification process failed, Zac felt like he was dying. Moreover, wondering "why isn't this working?" and relating the event to brain damage suggests that his RFID apparatus has 'forgotten' how to make sense of the situation.

Third, the emergence of RFID implants is helpful for understanding the trajectory of sensory modification in general, and in particular the acceptance level of the general public towards implanted technological enhancements. The history of RFID implants and grinding are inextricably intertwined, in no small part due to Amal Graafstra and his company, Dangerous Things. Though his implantation in 2005 was not the first among humans[32], Amal was a key figure in the formation of the grinder scene, and he continues to be a leading pioneer of commercially available implantable RFIDs. What difference it makes for an RFID to be implanted is something he has been answering for over a decade. Amal's experiences of moving from a hobbyist grinder towards a legitimate businessman required changing both public perception and the design of implants themselves. RFID tags are particularly instructive since they represent the nearly ideal qualities of any implantable device. The glass coating is more consistent and durable than a magnet's bioproofing, and its shape allows it to be quickly and easily implanted via a pre-packaged sterile injection kit. Though it's far more convenient to have a professional piercer conduct the procedure, it is possible to (somewhat awkwardly) do it yourself, which eliminates many of the social difficulties grinders face when getting magnets implanted. As for practicality, where some might have no interest in adding ways of sensing the world, most people can relate to being locked out of their house. RFIDs probably have the best chance (if not a good chance) of gaining general acceptance and possibly pushing other grinder projects into the mainstream.

Exceeding the grind: Dangerous Things making things safe

Even though he is still highly regarded by grinders and active in their social circles, Amal now prefers to distance Dangerous Things from the term 'grinder' in an effort to promote user-friendly products to a wider audience. First, he tells me, *grinder* has branding connotations that inhibit its saleability. Having a moniker more widely associated by the general public as a popular hook-up app (*Grindr*) creates an immediate consumer disconnect that would need to be overcome. Likewise, any association with 'transhumanism' might be detrimental. Even though Amal told me one of his goals is to "improve society [and] change humanity" with his products, he readily concedes "for a lot of people … transhumanism is probably pointless or they don't

[32]Kevin Warwick claims to be the first human to have implanted an RFID in 1998. At the time, he was a professor of cybernetics at Reading University (Warwick 2010).

have any interest in it." Second, *grinder* evokes an unflattering visceral response. "It has an air about it that's dirty," he says, adding, "It's gutter, it's grunge, it's cyberpunk." From Amal's perspective, some grinders enjoy this provocative aesthetic, or even promote it to keep grinding "dirty and underground," but it is not a good business model for achieving widespread adoption.

Creating acceptance of body augmentation required replacing pejorative language with something more positive. Amal's solution involves, in part, a reclamation of the word *hacker*. "[The] reality is I'm battling people's aversion to the word hack in biohacking. And so my definition of hack is 'an unconventional approach' – that's it. And by that definition any hack that's successful will become a non-hack. It will become standard and normal, and hence no longer a hack when it's something that is accepted. So the goal any biohacker is to just be called a biotechnologist." For now, he describes biohacking as "an unconventional approach to solving the problem of not being able to augment ourselves," which highlights its circumvention of "the conventional 20-year plan, university backed, IRB, FDA approved method." In the meantime, Amal has adopted the term *bionics hacker*, that is, a hacker of biology and electronics.

The grinder name is thus the first to go in progression from underground to mainstream. What else had to change? Reflecting on the last ten years of his efforts, Amal tells me that the most important thing he has been doing is "simply exposing people to this idea" of implantable technology as being safe and practical. This is reflected in how his consumer base has changed over time as he continued to spread the idea of implantable RFIDs.

Dangerous Things focuses on application-driven products. Unlike Grindhouse Wetware, who creates products that let the user create their own applications, Amal takes the position that enhancement implants will gain popular acceptance when people can understand exactly what it does already. "No normal person would say, 'Yeah, put a drill in my head,'" he explains, "but when the application is you get to keep your teeth and chew food people are like, 'Go for it! Drill away!'" Whereas Grindhouse is interested in pushing the limits of technology and biology, and will worry about widespread acceptance – or even applications – later, Amal instead aims to first reshape the perceptions of society to make it acceptable to implant something under the skin.

To achieve this, Amal has formulated four rules about the implants he develops and sells. First, the function must be continuous and somewhat permanent. "The idea of having a tool that you pick up like a smart phone, you become like a god, right? But everyone understands that's

temporary. Everybody. And when you put it down you're just a dumb human again." Second, it must have a minimum lifespan of 30 years. "If you're going to cut your skin open and put it in there, go through that trouble, even if it's minimal trouble like the injection, it still ought to be something that you can rely on long-term to be part of who you are." Implants are not temporary solutions, and the average person can't be excepted to keep cutting themselves open for new versions or failed components.

Third, no batteries, especially lithium batteries – at least for now. While a battery can be implanted with safeguards, the consequences of having a circuit malfunction are too great. As Amal points out, pacemakers have long used lithium batteries, but every electronic component in their circuit has been produced within tight tolerances and checked for quality control "from the ore that's mined from the ground all the way to going into the chest." The recent cases of exploding Samsung smart phones bear out his point. Fourth, and related to the third rule: no transdermal implants. While it may seem like transdermal implants would be a way to use external batteries to safely power implants, it also violates the first two rules. If it needs a wearable component to work, Amal argues it would be better just to make it a wearable device.

These tenets circumvent many of the general hesitations towards implanting something in one's body. All that remains, of course, is convincing people the applications are worth the effort of specifically getting an RFID implanted. Whereas grinders come from a particular set of relational circumstances that fosters a desire to challenge the skin's boundary (see chapters 2 and 3), Amal has had to build towards this outcome from scratch, often in the face of opposition.

After Amal implanted his first RFID tag in 2005, the story quickly spread through social media and tech bloggers, which led to further interviews. At the time, there was no maker movement or online instructions for DIY RFID systems, and Amal began to receive inquiries expressing interest, both positive and negative. In fact, the very first email was an accusation of being "the devil's mouthpiece," which he promptly printed and framed. "There was interest," he recalls, "but it was like freak show interest." A few other grinders with RFIDs also related stories about accusations of devil worship, or concerns about how "the government is going to chip everybody" (Berkelly), or how RFID will alter your DNA (Ben)[33]. I later confirmed that a

[33] Some grinders take this as an opportunity for religious resistance and hijinks. For example, Ben in SLC has programmed his to display '666' when scanned by a phone. Trybal Wolf has taken it even one step further. In the middle of telling me about their conservative religious upbringing, they reached back

cursory Google or YouTube search for 'RFID mark of the beast' yields a large amount of data to support the claim this belief is widespread.

Most of the inquiries Amal received, however, were technical questions about how to pursue implanting RFID tags. Over the following years the emails and workload increased, and when combined with a concern for people who were applying his ideas unsafely[34], Amal ultimately decided to write an instructional DIY project book, *RFID Toys* (2006). In August of 2012, he began formally selling RFID products under the name *Dangerous Things* to further promote the technology in an informed way. By attending maker fares and Association of Professional Pierce conventions, he set out to counter "the Hollywood movie education" that pervaded the collective consciousness by educating people about safety, myths about government tracking, and, of course, practical applications.

Other than the occasional accusations of RFID chips being the diabolical mark of the beast (and the accompanying death threats), in the first year of Dangerous Things the customer base was "purely – I mean 100 percent" people that understood how the technology worked and what could be done with it. They were familiar with the standards and protocols, and questions centred around the details of particular chips (e.g. storage, frequency), and were not worried about scarring. As time went by, the customer base shifted towards clientele that considered RFID tags more as an alternative to a piercing or a tattoo, and scarring was increasingly a concern. This suggests the *idea* of being implanted became the primary interest, with technological understanding becoming secondary (albeit still important) consideration. After a decade of giving interviews and social media exposure, Amal observed "the idea of getting a chip implant has softened the idea to the point where now people are more concerned about what

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and scanned between the shoulder blades with a cell phone. The phone then orated in a robotic voice: "Warning: Do not let anyone for any reason inject a chip in your right hand or forehead. It is amazing how specific the Bible is regarding the mark of the beast. Revelation chapter 13 verse 16: and he causes all both small and great, rich and poor, free and slave, to receive a mark in their right hand or in their foreheads. Notice it says in, not on. This fits perfectly since the chip is injected in the hand or forehead. Revelation chapter 13 verses 17 to 18 goes on to say: and that no man might buy or sell, safe he that had the mark or the name of the beast or the number of his name. Here is wisdom. Let him that has understanding count the number of the beast, for it is the number of a man, and his number is 666." Tribal Wolf laughed then added, "So if anyone makes a mark of the beast reference, I'm like, oh, yeah, no – *here*."

[34] Amal paraphrased the inquiries as "Oh, I cracked it out of a car key and I just rammed it in, you know."

they can do, [and] not like, 'is god going to send me to hell because I got an implant?'" They may not know as much about the technology, but, as Amal puts it, "they want to get involved; they want to be able to do magic." Being able to conjure 'magic,' however, is more difficult than just getting a tag implanted.

RFID networks, function and proficiency

Waving a hand with an implanted RFID may look like magic, but the trick only works if there is something that reacts. Without compatible supporting infrastructure, an RFID has nothing to act on. For interfacing with a phone, it must be a model compatible with the appropriate NFC or RFID protocol. For example, many (but not all) of the top manufacturers of cell phones support NFC, but at this point Apple iPhones do not support reading or writing of NFC tags[35]. Even with a compatible phone, some users have trouble picking up the signal of an RFID that is maybe implanted a little too deep.

Not only must the devices be compatible, so must the lifestyle. RFID pass cards are popular in Silicon Valley workplaces, but for someone like Will living in what he described as "low tech" Florida, there simply isn't a lot of RFID technology around. Evan, who rents an apartment, is not allowed to change the locks on his door. And once attached to an RFID ecosystem, future devices need to remain compatible. As Jordan points out, "it's kind of a pain to initially set stuff up, so if you don't have one place or one car that you're using for a long time then I would say it's not worth it." Some people get multiple tags for multiple purposes – after all, there is plenty of room in the body for such small implants. But unlike a magnet, which heals and works on its own, an RFID tag can end up being a key without a lock. This is especially true among grinders, who, unlike others that specifically seek out RFID tags, sometimes get implanted out of convenience or because that's just what grinders do (e.g. a spur of the moment decision at Grindfest) with no specific application in mind.

Even with all of the necessary compatible components, getting them to work as wanted requires some degree of expertise. Having abandoned his 'cyborg calling card' when most phones couldn't read his NFC, Stephen turned to reprogramming his motorcycle ignition with

[35] It does use NFC for Apple Pay, but other NFC functions are not enabled

the help of fellow grinder Ben. The process was, to say the least, technically challenging. Try to follow along:

> Step one was basically just to get the reader, which is the basic -- I think it's Arduino One or Arduino Nano. Can't remember which Arduino board it is, with the typical NFC reading antenna. And then once we had that we had to figure out essentially how to hotwire my bike because the idea is that when you scan your tag the Arduino basically hotwires the bike. So we had to find the pin high and pin low for the hotwire. Most motorcycles have three wires in their ignition and you can literally just cross two of them and the bike will start, or -- it's like turning the keys, rather. With mine there's seven wires, three of which are kind of redundant, and what they don't tell you is that there's a resistor in the ignition that's not in the diagrams. So I basically got on motorcycle forums and found someone who had had the issue with the same bike. They had a very non-traditional wiring diagram to explain the resistor. Trying to interpret basically like a five-year-old's electrical drawing, essentially [laughs]. But we finally got that working, then we had to figure out how to keep the key still working, so we had to re-route three of seven wires to basically be loops into themselves, so we dead-ended three wires coming out of the ignition, looped those to themselves going back to the motor, basically, and then left the others as they were, which are basically powers and grounds. Luckily, one of the redundant lines is a power line, which made it a lot easier to hook the Arduino up. Then once we did that we realized we needed a switch because otherwise the Arduino would constantly be pulling power, and if I left my bike sitting for long enough that could drain the battery. I mean, it probably wouldn't be a problem with daily use, but leave the bike for a week or two and come back to a dead battery. So we [3D-]printed up housing for the Arduino board and the antenna, and then [3D-]printed up a housing for the switch, and mounted the switch on my handlebars and hid the reader underneath the symbol on my fairing. So now basically I've flipped a switch, takes a couple seconds for the Arduino to turn on, and then I run my tag which is also in the classic location between the pointer and the thumb, and just run that over the antenna. Had some issues with it because it's NFC with read distance, so we basically have had to devise a way to put a bushing in there

> to shove it up against the reader so that it works reliably. At first it was at the gas station when I first had it and some guy saw me just, like, rubbing the side of my bike [demonstrates rubbing the bike in a kind of exaggerated and provocative circular back and forth motion, laughing]. So, yeah, now it's working all perfectly and, thank goodness god, in order to do all that we had to take off basically everything but my gas tank, which is fun because I have crash bars and a bucket of bolts, I don't know, maybe a hundred and some odd bolts.

Even though I was familiar with the devices, it was clear to me that such an operation would be well beyond my expertise. Having now known McSpanish and Ben for a few years, to describe them technically and mechanically competent would be an understatement. Stephen's description does not even address setting up or programming the Arduino, which adds another level of required expertise. While RFIDs are meant to save time and effort (i.e. memory), they also end up requiring new forms of labour, maintenance, and education that were perhaps not anticipated (see Cowan 1983).

To be fair, pairing an RFID with a modern motorcycle ignition system is one of the more complicated applications, but the minimum threshold of technical literacy for even something as simple as unlocking a cell phone still exceeds a portion of the general population. Even people who are interested in RFID express difficulties in figuring out the technical aspects, as evidenced in the *RFID Implantees* Facebook group run by Dangerous Things (to be clear, many of the posts pertain to products not made by Dangerous Things). Of just over 500 threads in 2016, about 38 percent were questions. Roughly half of these were about getting implants, such as looking for implanters, where to implant, questions of health or security, whether it is compatible with boxing/climbing/diving/other lifestyles, and 'does X work with Y?' type questions. The other half of the questions were technical in nature such as how to get systems to work, problems about phones not reading the tag properly, how to program tags, and 'X is not working with Y' type questions.

In addition to being a place for answers, the RFID Implantees Facebook page also serves to celebrate the successes of RFID proficiency. Over a quarter of the 2016 posts were either links to media articles about RFID applications, videos of implantation procedures, pictures of newly implanted tags (which usually amount to a small, slightly red spot on someone's hand),

and anecdotes of successful uses of the implants out in the world. Sprinkled amidst these accounts of struggles, failures, and successes are references to transformation of identity. Posters describe their reasons for implanting as "to become cyborg," and that "The idea of becoming a cyborg has always truly delighted me." Newly implanted posters begin with phrases like "Hello cyborgs" and "Hi fellow cyborgs." They share pictures of "Cyborg Selfie-Time," ask "Any cyborg ladies around here?", and receive responses like "wellcome to the Cyborg family" (sic).

As much as the 'cyborg' label represents a successful self-identification, it equally requires an ability for objects outside the body to identify the implantee. One isn't a 'cyborg' until the RFID is both inside the body *and* recognized by external devices. Achieving this mutual identification requires work, expertise, and, above all, the stability of a digital infrastructure. The body is integrated with a system that cannot be put down to become a 'dumb human' again, to recall Amal's words, however, the body must now maintain this equilibrium via brand loyalty and a consistent lifestyle. Yet as much as this mutual sensibility affirms the identification process, its extension beyond the body opens up new avenues for interference in between the RFID and body.

Identification insecurity

In Amal's and grinders' accounts of dealing with the public, in the RFID Facebook page posts, and in the comment sections of media articles, a recurring objection to implants concerned the idea that RFIDs facilitate unwanted tracking. According to grinders, these concerns are largely overblown. For one, unless the tag has been bought directly from the government, no one would be aware of the tag's unique identifier. Second, RFIDs have what was commonly referred to as 'security through obscurity.'

> Everybody thinks it's for tracking people. Everybody thinks it's security-less, and very easy to break into something with RFID because, hey, it's RFID, I can copy it, there's no security on it. You're kind of right, [but] they have to know about it. Some people are saying security through obscurity is not security. I say, how the hell is it not security when you don't know it's there? Just not knowing it is security. (Paul)

Many implantees take refuge in their additional fleshy layer of security, away from prying eyes and nimble hands. But as Drew, an employee with Dangerous Things, explained to me, this may be more convenient for the implantee but it actually isn't a huge improvement security-wise. Being a passive device with a limited readability radius, it is unlikely that someone will read and copy your tag, but it is possible. Because RFIDs have static identifiers (that is, their unique ID doesn't change unless you re-write the tag manually), this means "anybody can just come up to me and scan this and then walk away and plug it into their thing and then come back and use it again" (Drew). In fact, with a long-range RFID cloner (say, stuffed in a briefcase) it is possible to copy RFID data from up to three feet away (see Marsh 2013). At this range, it makes much less difference whether the RFID is in your purse or under your skin. In other words, while waiting at the bus stop, someone with an RFID reader could get close enough to scan your hand, then clone it to their own RFID tag. They just stole your bus fare, or house key, or credit card, or bitcoin wallet, and can now represent themselves as the digital-half of your identification. Putting a tag inside the body only hides it; it doesn't *internalize* it, since somebody else can still 'be you' digitally.

Historically, there have been many attempts to secure personal identification. As gathering statistical data gave rise to the idea of a 'dangerous recidivist' towards the late-19th century, the governments of the USA, Australia, and New Zealand each developed fingerprint databases. John Pratt (2000) describes how "This new technology and knowledge thus allowed greater verification of the extent and nature of recidivism" (p. 12) by creating biometric markers linking identification to the body. In 2014, over a hundred years later, an amusing thread on the Biohack.me boards ("Fingerprints" 2014) brainstormed how to get rid of fingerprints. The possibilities ranged from poorly thought out (e.g. acid, which would probably make prints even more distinct) to the obvious (e.g. gloves). Their cleverest solution, however, was to scan the prints and release 3D printed models onto the internet, thus undoing their uniqueness. That same year the Chaos Computer Club reproduced Ursula von der Leyen's fingerprints from a high resolution photograph posted on the internet (Kleinman 2014). If biological markers, like fingerprints, are used for identification, then we are all now the German Defence Minister.

While current technologies have attempted other biometrical forms of identification, such as iris scanners, they run into the same problem. The problem, simply put by Amal, is that technology has outpaced biology.

> People talk about, well, you could tie it with fingerprints or iris scans or DNA, or anything like that, and it doesn't matter if that biometric is externally samplable or not. I mean, it all is, right? You leave your DNA everywhere. You leave fingerprints everywhere. Your iris and your thumbprints, everything's on Facebook. I can just get a high res photo of you, or a series of photos of you and make a 3D model of you. The problem is your body is analog. Typing a user name is analog. The keystrokes are analog. They might be digitized along the way, but everything analog can be sampled and emulated, and that's the problem. (Amal)

Even using memorized passwords will not work since they have to be written out or typed at some point. Plus, as Drew put bluntly, "Passwords are idiotic and expecting people to remember them is idiotic." As Amal further explained, you can't even open a bank account without some form of ID proving who you are – your physical body is not 'you' enough: "You can't participate in modern society without digital identity, and the method we secure this digital identity is ridiculous."

The stakes of digital identity are high for someone like Trybal Wolf. Comparing it to physical, mental, or spiritual identity, digital identity is

> almost the most important, because it has the potential to live for the longest. The digital is your internet legacy. My digital identity is how I portray myself. It's every word I've ever spoken on an internet forum. It's every picture I've ever shared. It's every account. It's every profile photo. It is who I am on the internet. It is the data that I will push out into the universe that will probably last longer than anything else. I find that quite beautiful. So for me, I value my digital identity more than I do the physical or anything else. (Trybal Wolf)

Trybal Wolf's concerns about digital identity may be at one extreme, but they also extend to someone who does not engage with the internet at all. As Amal explained to me, even without banking online or participating in social media, or even owning a computer, everyone has a digital footprint somewhere in government records: "As long as you have a name and you're on

the books -- it's no longer a book, it's a database." There is an accumulation of digital identity occurring with *and without* participation. And since digital accumulation is not physical, yet requires material collisions, it is not the information itself but the circulation of information that poses the biggest security threat. In other words, the security of digital identity is threatened when identification processes are jeopardized.

"What is identity theft?" Amal asks, then answers himself: "It's the fact that when you are assuming someone's identity to anybody else you're communicating with or transacting with. They would assume you to be this person." He follows up with a list of easy ways to falsify digital identity, from forging SMTP protocol (i.e. making an email appear to come from another address, for example president@whitehouse.gov) or spoofing SMS (similar, but with text messaging).

It isn't just identity but the very ability to communicate that is threatened. "Our private and public lives are on the cloud, but without being able to prove identity in that way you're at a constant risk of that identity being usurped," says Amal. Ironically, as Trybal Wolf pointed out, digital identity has become arguably the most permanent form of identity, and yet Amal asserts it is also the easiest to lose: "…if you've ever had an account hacked, like a social media account hacked, or twitter or anything, they do not engage in identity verification. You're fucked. Your option is get a new account, and you give up that history."

VivoKey: (re)interiorizing identity

Evolving evolution

For Amal, the cause – and the solution – to securing digital identity/privacy is found in an evolution of evolution. His explanation is as follows. In the standard theory of evolution there is selection and mutation, "at the very root of it, survival of the fittest." But this is no longer the case, since 'fittest' means the best to survive in any given environment, and not only do we all live in different environments but humans have also modified themselves towards certain ends using particular tools. Once humans started using tools, 'fitness' further extended to different mental capabilities and problem solving related to those tools – "A slight adjustment to evolution, but not a fundamentally different thing." As part of this adjustment, however, humans could now opt out of certain selective processes, like taking control of diet, and deciding what

makes an appropriate mate. "Now it's like you can just float around in society doing the bare minimum and find somebody and have kids with them. So the selfish gene is less picky now."

In fact, Amal suggests it may eventually be possible to opt out of selective processes completely with human mortality, but for now he is interested in the mutation process that was once random, but is now anthropocentric. He points to commercially available pet cloning services in China, as well as the increasing possibilities for implementing genetic choices, as well as supplemental augmentations in performance through implants. In fact, he argues this is not so different from what medical providers are already doing:

> So the reality is if you break down the body to functions, your kidneys work great. They do their job; they filter blood. You take those kidneys out, you don't have that ability anymore and it's lethal, right? But it's simply an ability. You can take somebody else's kidneys, put it in there, they'll do it. You have to have some anti-rejection drugs, whatever, but they're a thing that does a job, a tool for your ability to live. […] There is no difference logically to having a cryptography system implanted. Now, you as a person, encased in this skin bag with the certain tools inside of you that do their jobs, there's really no difference. So psychologically and fundamentally an implant like that has no management, it's not a temporary thing like a pacemaker's designed to be. It's a permanent thing. It's become part of you and who you are. And that's the fundamental difference when we're talking about identifying as a human being with certain capabilities, right?

Soon, Amal argues, these will be "mundane choices that we make, so it's a new kind of evolution in the way that we'll have the choice to implement these things in our bodies and in a way that we just did not have an option to do before." The choice Amal makes is to secure his digital identity through an implantable, cryptographically secured RFID technology he calls the *VivoKey*.

The VivoKey aims to resolve the aforementioned function and security problems of RFID/NFC chips by using cryptography to store security tokens. It can be updated via software, so it will not become obsolete. Security tokens basically work as follows:

i. Security tokens use cryptography and public/private keys to maintain privacy and guarantee the identity of one of the parties. A security token is a physical device used to gain access – a key. These can be, for example, a security badge or an NFC chip.

ii. A security token can store a cryptographic key, which contains a mathematical algorithm for encryption. The algorithm is encrypted, or 'locked,' so this calculation cannot be seen.

iii. Private and public keys are paired, and each can lock (encrypt) and unlock (unencrypt) information, but in different ways, or 'directions.' The private key can lock information in such a way that anyone with the paired public key can unlock. Anyone with a public key can also lock information, but in a way that only the private key will be able to unlock it.

Even without understanding the above concepts, what is important is how they can be applied. There are three main ways of applying these principles for security. First, the holder of the private key can guarantee they are the sender of the information. Anyone with a public key can read it, but only the holder of the private key could have sent it. This is useful for 'signing' messages to prove identity. For example, if a bank wanted to inform its customers of something important it will 'sign' their message. The customers would use the public key to confirm the message came from the bank and not someone posing as the bank.

Second, the holders of the public keys can send information that only the private key holder can read. Anyone with a public key can send a message, but only the holder of the private key can read it. This is useful for communicating with a particular entity. For example, if Tom (holder of public key) tells his bank (holder of private key) to conduct a transaction, no one else would be privy to what that transaction entailed except the bank.

Third, the first two methods can be used together. For example, the holder of the private key can 'sign' the information and then further encrypt it with someone else's public key. This guarantees the sender's identity, and only the receiver will be able to read it.

The problem with most private keys is they are stored on computers, USBs, cell phones, or other material domains that are possible to hack, lose, steal, or otherwise compromise. "Until you actually have a cryptography implant that you can mathematically prove identity, mathematically sign a transaction," says Amal, "you're not really securing that account."

Combining NFC with security tokens eliminates each of their weaknesses by internalizing digital identity into the body. A computing device is still needed as an interface, but the security token is embedded safely under the user's skin. The user shares their public key through the app, and then only they will have access to it by bringing their phone (or other device) near to the implant.

Since Amal has designed the VivoKey to be a platform for companies to adopt, the applications are plentiful. By downloading a company's app, the VivoKey can secure credit cards, bus passes, bitcoin wallets, or any other transaction. He is currently in talks with credit card companies to facilitate contactless payments. All the user has to do is share their public key with their bank, email provider, and other communication programs. The applications do not end here, however. Amal sees it being used for national identity cards. In Estonia, he tells me, they already have e-residency cards that are necessary to access consulates or embassies, set up bank accounts, or pay taxes. "According to the Government of Estonia, that is you. So you protect that card with your fucking life, and the PIN code and everything." With a VivoKey, it is protected with perhaps not your life, but at least the integrity of your body.

Sensing identification

When the common RFID implant remembers our keys, it becomes a permanently interiorized reminder that we cannot be locked out of the house. But what does the VivoKey remember for us?

Giddens (1991) once argued that late modernity has led to an instability of identity that is expressed in superficial, consumptive lifestyles. From this perspective, the VivoKey is a self-contradictory artefact, where people can opt in to a 'cyborg' identification that provides digital stability. This stability is not just self-identity, as Giddens was speaking of, but also institutional stability. Amal points out that "cards, wallets, and keys on keychains, these are not permanent [and] there's no expectation of it, either." The VivoKey, however, permanently remembers not only these objects, but also the objects they attach to. It can remind the user of banks, of nationality, and, moreover, it places the onus of that stability on the implantee by creating an expectation of identification permanency. It displaces some of the instability of these institutions to the security of the skin. The RFID becomes a sensory cyb/organ capable of identifying and being identified by digital entities.

At the same time, RFID networks also rely on stability from the material connections in between. Ron's implanted Chinese RFID tag worked fine, but the infrastructure too often did not. "The dream of NFC, it'll solve everyone's problems. It can communicate with anything. Program my phone to do stuff, turn on my lights, unlock my door, start my car. I had high hopes for that. […] In theory they work great, and then your guest has to make sure the wifi's on and take their phone case off and scan it to get your wifi password, and then they hate you. It was great in theory, terrible in practice."

There's an old adage, 'Locks are for honest people.' Cars can still be hotwired, doors can be broken, windows shattered. So while the good thing about VivoKey is it guarantees identity, the bad thing is, it guarantees identity. I wouldn't be surprised, for example, if Estonians were hesitant to have their identity so 'secure,' given their recent Soviet occupation. Having a wallet in your body secures your bank account, but it also inscribes debts and patterns. Maybe the government wouldn't be able to track users, but corporations will have guaranteed knowledge about which ATM location was used to withdraw cash, and credit card companies would know exactly which VivoKey purchased what product with no deniability.

Of course, a person could have several VivoKeys or they could cut them out, and this is where the crisis of security returns: which continuity should prevail, the identification of the skin, or the identification of the memory? The former is at the mercy of an instable digital identity they may not have even wanted. The latter, it would seem, inextricably places the body within a surveillant assemblage (Haggerty & Ericson 2000). The VivoKey provides a metastability to the infrastructure on which it relies, one that is necessary for users to securely gain access to the information (e.g. a bank account, email). VivoKey guarantees security of identification through encrypted requests for authentication, but the secured identity "could just as easily be rejected on a given day or between certain hours" (Deleuze 1992, p. 7).

Amal predicted that "We're approaching this point of empowerment, digital empowerment where there's no excuse for not securing a digital identity." But is there value in being able to lose or forget something? Amal and the bar patron in Stephen's opening story each advocate self-responsibility, though they take different perspectives in the crisis of security. The crisis forces a reorientation of the body according to what a person wants to sense and/or have made sensible about them. Unlike Haraway's cyborg that challenges socio-material boundaries

and identity, in RFIDs the cyborg is a push towards homogeneity marked by a need for protocols and infrastructural stability to maintain digital identification.

Chapter Eight
Platform Bodies:
The Echo and the Daemon

> Information now expands to such an extent that it no longer has anything to do with gaining knowledge. Information's immense potential will never be redeemed and it will never be able to achieve its finality. It's just like the debt. Information is just as insolvable as the debt and we'll never be able to get rid of it. Collecting data, accumulating and transporting info all over the world are the same thing as compiling an unpayable debt. And here too, since proliferating information is larger than the needs and capacities of any individual, and of the human species in general, it has no other meaning but that of binding humankind to a destiny of cerebral automation and mental underdevelopment. It is clear that if a small dose of information reduces ignorance, a massive dose of artificial intelligence can only reinforce the belief that our natural intelligence is deficient. The worst thing that can happen to an individual is to know too much and, thus, to fall beyond knowledge.
>
> Jean Baudrillard (1997)

In the previous chapters I have demonstrated the complicated relationship grinders have with time. They seek to pre-empt frailties of the body, and in doing so bring about the conditions they hope to pre-empt. They do not want to wait for the future like other transhumanists, so they adopt a DIY praxis of incremental progress, no matter how slow – the *grind*. Their projects have developed gradually, particularly when testing biocoatings. The tempo of life slowed down when magnet implants promoted exploration and contemplation, but then was immediately accelerated by peripheral devices. RFID implants began with precluding time spent managing keys, but then became an axis for the struggle to maintain digital (and corporeal) identification.

Grinders are future-oriented yet their emphasis on practicality also keeps them within the bounds of current technology. Their bodies are at the nexus of competing temporalities which simultaneously demand they hurry up and slow down. Nonetheless, they are encouraged by what they've learned so far and how it might apply in the next wave of implants. "With magnets

we've proven that you can add any arbitrary information in and your brain will start making use of it, so it could be much more useful things," Marlo told me. He then went on to hypothesize, "It could be from sensory prosthetics. It could be used to drive new parts of a body you didn't already have, like new organs, new limbs. It could be used for communication between people." Grinders will occasionally slip into speaking about the future in terms of hundreds or even thousands of years, but such prognostications are then inevitably pulled back to the present. Speaking about Grindhouse, Marlo assured me "it's going to be a long kind of trip, but we're ready to start the trip right now."

I asked Marlo, if each device they were working on was a step towards something, then what was that *something*? "Neural interfacing," he replied. "It's literally the whole fucking point of grinding, as well as the culmination of this entire information revolution that's been hitting us. It's the end point of things like cell phones and computers. It will eventually take us all to the stars and probably a bit further." According to Will, making humans part of the Internet of Things (i.e. inter-networked sensors and devices, Kitchen 2014) is "where everything's headed." Neural interfacing, often made reference to involving a 'brain computer interface' (BCI), is an idea that's been floated in the grinder scene since its inception, and in science-fiction well before that. To grinders, the plausibility of a BCI already seems to be supported by the results of their magnets, peripherals, and RFIDs, which make possible sensory networks between brains (via the body, if not directly), objects, and the digital realm.

Such a perspective conceives of both the BCI and the body as *platforms*, which Jordan (2015) defines as a plan for organizing how information circulates and then recursively feeds back into itself (p. 24). In combination with a BCI, the body is constantly reacting to information that in turn produces more information for reaction. The information the body-BCI assemblage collects can be from itself, or from somewhere else, but it all becomes part of the same body. It integrates itself into the body's sensory network, much like Merleau-Ponty (1968) described when two hands touch each other into existence. But a BCI is not quite as tight a phenomenological loop, as Jordan (2015) goes on to point out that the material basis of platforms configures a 'battleground' for a politics of information. The platform has access to a glut of information, and then must create meta-information about that information to determine what is relevant or important. The 'battle,' then, takes place over which information is to be processed

and how. The very idea of having a BCI is therefore contingent upon both decisions about what information is sensible, and also the role of information itself.

Paul Ricoeur (1992) provides some elaboration on this point in his application a science-fictional BCI to theorize questions about how self and selfhood connect the idea of sameness. His analysis begins with the thought experiment of a brain being copied and then transported into a replica body, thus eliminating the psychological and bodily criteria of self-identity. The question is what identity survives in the replica, or, put another way, whether the process of copying and transporting replicas interferes with the identification process. Here, Ricoeur argues against Parfit, who claimed personal identity is merely a 'supplementary fact' to the psychical and/or physical identity. If the answer is undecidable (and so far, this is surely the case), Parfit says it is because the question is empty, and therefore personal identity is not what matters. In other words, the question and therefore the answer is insensible. Ricoeur then turns the question back on Parfit:

> Parfit's puzzling cases are imaginative variations which reveal as contingent the very invariant condition of a hermeneutic of existence. And what is the instrument of this circumvention? Technology – not actual technology, but the dream of technology. Imaginative variations of narrative fictions bear on the variable connection between selfhood and sameness, the imaginative variations of science fiction bear on a single sameness, the sameness of this thing, of this manipulable entity, the brain. (Ricoeur 1992, p. 197)

Even if such experiments are not physically possible, for Ricouer what is important is that they are *conceivable*, because the narratives themselves reveal what is at stake for personal identity; not just because of the technology they are (maybe) contingent on for the identification process, but also because of the narratives about the technology itself. Between Jordan and Ricouer, we can see that even the *idea* a BCI is a battleground over how information and identity are, or ought to be, co-implicated.

Grinders, to date, have not implanted a BCI, but they talk about them frequently and have even built prototypes in varying stages of completion. Their pursuit falls into the category of 'cyborg sciences,' which, according to Mirowski (2002), "depend on the existence of the

computer as a paradigm object for everything from metaphors to assistance in research activities to embodiment of research products" (pp. 12-13). Cyborg sciences investigate the reduction of nature, the social, culture – anything, everything – to a matter of computation and data. But 'data' itself is not stable, since they depend on circumstantial "ideas, instruments, practices, contexts and knowledges used to generate, process and analyse them" (Kitchen 2013, p. 2). To envisage a BCI is therefore to to conceive of a mode of identification based on how certain kinds of data act on bodies.

In this chapter, I examine grinders' narratives about BCIs in general, and then specifically about two BCI-type devices – the *Beezy Echo* and the *Daemon Worshipper* – to trace how grinders' cyborg science enacts assemblages of bodies, senses, materials and information. It shows how BCIs act as a battleground for a politics of information, where the question of access is defined by the inevitable collision of material platforms.

BCI and the platform body

What is a brain computer interface and why do grinders want it?

As explained to me by Jordan, a BCI creates the "ability of digital and biological systems to complement each other." He went on to share some philosophical implications of having computers overtake the brain, including a 'ship of Theseus' scenario whereby neurons are replaced one by one with electronics. "What would you feel like?" he asked. "Would you still be you?" These sorts of philosophical and ethical conundrums have been pursued in pop culture, notably in *The Matrix*, *Ghost in the Shell,* and *Robocop* films, plus any number of Philip K. Dick novels, and the end game is mostly the same for grinders: the brain is uploaded to a computer, thus allowing the 'self' to be 're-uploaded' to new systems and therefore live forever, for better or worse. In present reality, commercially available non-intrusive BCIs, like the InterAxon *Muse* headset, can already convert electroencephalography (EEG) signals into audio for purposes of meditation, stress reduction, games, and to help learning, but Jordan dismisses these devices as "imprecise and unidirectional." At the other end of the spectrum, experimental medical BCIs for probing neurological activity can involve invasive surgery to implant electrodes directly in the brain. This is clearly outside the scope of what grinders are capable of, which is part of the reason Jordan has withdrawn from the grinder scene to pursue degrees in neuroscience and engineering.

For now, grinders are aiming for something in the middle, something that will at least further the pursuit of "getting more connected, basically," said Marlo. A neural interface, he told me, is meant to overcome the bottleneck between humans and computers; eyes can only absorb so much information from a screen, and hands can only input so much information by typing on a keyboard. A BCI can pick up the sensory slack, so to speak. Drew and Anita have also given thought to the inefficiencies of the body for processing information. In what they call their 'qualia' experiment, they are attempting to "see what qualifies for our interpretation of consciousness and then work down" by ascertaining how to get "minimal data" into the body at a useful level (Anita). Drew gave me the hypothetical example of finding the "minimum viable product" for interacting with the world (and, more specifically, Reddit.com) through a singular blinking LED. By cutting out the excess information the body doesn't 'need,' it will help alleviate the bottleneck for "information moving back and forth between the computer and you," as Marlo put it. He then asserted that "it's great to have this super detailed sense of touch over my entire body, but I don't need it to get by. I could get by with a tenth of that resolution and I would be fine. And if that means I got nine-tenths of my sensory thing, or place for other useful senses, I'd be pretty fucking excited."

Marlo, Drew, and Anita are essentially trying to identify the boundaries of their given platforms, that is, their bodies. Their narratives are toeing the line of the sensible. In science fiction stories it may be possible to download a brain into a computer and vice versa, but grinders are confronted by a biological reality of limited bandwidth, so to speak. For grinders, a BCI is conceived as a strategy for efficiently processing information within corporeal boundaries. It would essentially be an informational sense, capable of discerning what is worth paying attention to. Marlo sees this process as a logical progression from people communicating over telephones, to using computers to talk to each other, to eventually people using just their minds. Extrapolating from his experiences with the Bottlenose, he figured that eventually, "rather than just repurposing existing sensory channels, we'll be able to add entirely new ones. So instead of having to sacrifice a little bit of touch for an electric sense, you'll be able to just add a new electric sense in. … We'll be able to change our minds so they work in different ways than they work right now. Make them much, much more complicated, much more comprehensive."

A trend among these accounts is the increasing importance of digital solutions for participating in modern society, and the decreasingly useful biological system. For Jordan, this

is a question of processing large amounts of data for coping with imminent problems and predicting future ones:

> The human brain is incredibly good at certain things, like pattern recognition, for example. I can see that that's a chair and this is a table and you are speaking to me. But I can do that effortlessly, and I can do that incredibly reliably. Computer systems -- digital computer systems, especially -- can do that, but it's incredibly costly and it always will be because of the nature of that system. But they're incredibly good at other things like computation, for example. Anything mathematical, anything predictive, anything that can be reduced to ones and zeros computers are incredibly good at, and we will never be able to beat them. So if you're having a math competition one computer will beat the entire rest of the human race, and it always will. It's because the two systems are fundamentally different.
>
> So I'm really interested in seeing how we can fuse the two together and get them to interact with each other in a useful way. So say you're able to, for example, record from the entirety of someone's brain, you're able to know what exactly they're thinking about at a given moment in time. Say I think about, oh, how do I create an analogue filter for something? It's an electrical engineering thing. Nowadays I have to pull out my laptop, Google it, search through the various results that come up, and then follow a certain procedure and I learn how to do it. If, however, you have direct access to the person's brain you can do that automatically and ahead of time. So you can search through whatever results you need to on the internet or elsewhere, and you can serve the person exactly what it is they're looking for instantaneously. So someone wants to know something, they know it immediately. And it's not that someone wants to know something and then they know it, it's that someone thinks about something and they do know it because there's a seamless integration -- or I would like to see there be a seamless integration between a human brain and a digital system such that you can't tell the difference between what is being given to you and what you already know. So if you were able to do that you'd effectively have a human being that knows how to do everything. They know every piece of information that's ever been produced and they can access it just by thinking about it. […] Being able to know anything and make

> connections that you couldn't possibly make otherwise, just because the information is so far away. (Jordan)

Information being 'far away' and needing quicker access to it is as specific as most grinders would get in interviews about what they hoped to achieve with a BCI. In fact, when pressed for something more precise the response was usually some variant of '*it could be anything*.' Not only was information deemed too far away, dedicating even the smallest of existing sensory resources to find it was decried as overly cumbersome. For Will, existing devices of convenience are still not convenient enough: "Everyone's all big about using Siri and Cortana and all of those these days, but you still have to be able to hear that information or look at your screen. Having that information instead on a minute-by-minute basis, have it by the second or without actually having to have a device that you need to charge and carry around with you and take your eyes off the road and do dangerous things like that. Not that I think we need to cut costs to education at all, but I think it would revolutionize the education system for sure, because the whole idea of having to actually memorize things seems would probably start to disappear."

This progression towards the "ideological hype" of a "technotopia" was theorized almost 25 years ago by Kroker and Weinstein (1994), which they described as a desire to have "the world as information completely at the beck and call of the possessive individual (the individual, that is, who is *possessed* by information)" (pp. 9, 15). But this is, I think, only part of what is going on. Certainly, grinders' rhetoric about the connection to unlimited information as empowerment is the loudest, but in Will's comment above I was struck by a few words that seemed out of place: *take your eyes off the road*. Instead of a desire for unfettered access to information, this fragment of a phrase points to the opposite problem, that is, the difficulty of being confronted with so much information at once that the body's existing senses are overwhelmed. Ben also surmised that people are interested in BCIs because "it gets us out of our technological addictions where we can experience the world around us while still being connected." The irony of implanting a BCI to counter technological addictions suggests grinders are in a state of what Andrejevic (2013) calls 'infoglut,' where information is no longer pulled when needed but instead *pushed* upon them, requiring new strategies to shortcut the sorting

process and make sense of it all. For grinders, these strategies are cultivated amidst a struggle of digital versus analog mechanisms for processing information.

Wanting more information and also having too much information

When talking about the potential of BCIs, I noticed grinders spent more time imagining being connected in general rather than being connected to anything in particular. Examples were occasionally briefly suggested for possible applications, but even when connections to specific elements were mentioned, they were often more of an afterthought. It wasn't some specific goal that required a BCI, but rather something that would be made possible with BCIs. For grinders, BCIs offer efficiency, speed, and prediction of information, but to what end? It seemed to me that BCIs are not supposed to solve *a* problem. They are meant to solve *the problem of having problems*. It is a platform for problem solving. As the solution, a BCI is imagined to redefine the conditions under which problems can be thought.

While most grinders maintained a high-level perspective of vague prognostications, there were two grinders each developing a prototype BCI device. To date, neither have been implanted, and one of them is yet to even be assembled. Nonetheless, as 'platforms,' we can look at these devices' material boundaries to gain insight into their "plan for organizing the production of recursions that will also define their benefits" (Jordan 2015, p. 24). In other words, they point to how their builders conceive of the role of information both as a problem (an infoglut) and a solution (a sorting/shortcut device), and how that information might be productive.

Beezy Echo

In my interviews I asked which of the other grinders' projects they were most interested in, and the most common reply was the implantable Bluetooth headset being developed by Ben Engel (known on biohack.me as Benbeezy). Ben has never given it a proper name, referring to it only as "the Bluetooth head implant thing," but in the grinder scene it is more commonly called the *Beezy Echo*. Ben's idea for the Echo was derived from a hybrid of Rich's induction coil/tragus magnet apparatus (see ch. 6) and Neil Harbisson's cyborg antenna. Harbisson is a colour-blind, cyborg artist who developed a device that converts colours from images into sonic vibrations, which are transmitted via an antenna implanted in his skull. It allows him to hear the

colours of whatever the antenna points at. But Ben does not want to just hear colour: "It was kind of the idea, we see with our eyes and a picture's worth a thousand words, and audio's not, but why can't it be?" Rather than only 'seeing' what is nearby, Ben's Echo is more like a BCI that can sense anything programmable.

The device itself is relatively simple. Take apart an off-the-shelf Bluetooth headset, switch the speaker out for a bone conduction transducer, hijack the battery with a small wireless charging circuit, and replace the on/off switch with a Reed switch[36]. Ben intends to implant it in the flatter area of the skull just above the ear, where it would vibrate audio into the skull transmitted from a computer or smartphone. It could be physically concealed by hairstyle or a hat, he adds. Making it all work together properly has been difficult, with Ben having gone through "thousands of iterations" of stacking the components just right, and experimenting with different biocoatings that are durable yet allow sufficient vibration for bone conduction. As such, he hasn't implanted it yet, though he came close to doing it at Grindfest 2 until the bio-coating ended up jamming the conduction transducer. It no longer vibrated, and so no sound could be produced.

Other grinders found the Echo appealing for its further corporeal integration with technology, such as being able to take phone calls privately (Evan), listening to music (Berkelly), and getting to the point where "You are the technology" (Deb). Though these applications will be possible, according to Ben they miss the point: He wants to see if it's possible to merge digital information with biological capacities, while having some control over the mediation between them. In other words, he wants to find new ways of sensing the world. "I'm doing it," he told me, "so that I can be more connected."

While the device is relatively simple electronically, the way it 'senses' the universe can be programmed in many different ways. In fact, the first example Ben gave me was far more complicated than a 'turn one existing sense into another,' electro-synesthetic conversion. As he currently has it set up, the software scans Twitter and assigns values to certain keywords he's determined are "sad words, happy words, excited words, scared words," and then performs an assessment of an overall emotion. It scales the values relative to each other and the resulting

[36] A reed switch is an electronic component on/off switch that is activated by inducing a magnetic field. In Ben's case, he could swipe any of his implanted magnets near the switch, and their magnetic field would go through the skin and activate or deactivate the Beezy Echo.

calculation produces audio signals of varying pitches. "If everybody in the world is tweeting happy thoughts – which is never going to happen in history – then my happy thoughts frequency would be at 100 percent volume." The assignments are limitless, and Ben enumerated multiple possible measures, such as depression or narcissism. "Apparently Neil Harbisson dreams in colour now, [… so] why I can't dream in other people's emotions?" Ben's Echo is essentially a sensory cyb/organ that can transform a glut of information into a feeling.

For Ben, the actual results of how Twitter 'feels' isn't as important as what he expects may be possible to prove by interiorizing data-mined information. When done by corporations and government, the datamining of social media is often critiqued for for violating privacy and practices of social discrimination; however, Kennedy and Moss (2015) note that it can also be used as a means for the public to "be more knowing of itself and to participate in the active production of itself" (p. 9; see also Lupton 2014). "In the beginning it's just all bullshit," Ben predicts. "You don't know what the hell is going on and you're trying to consciously distinguish between these different sounds. Your brain is really good at filtering out white background noise, like when you hear an AC [air conditioning unit] going and you're reading, you don't hear the AC. You just blur it out, right?" His hypothesis is that by subjecting himself to these predefined senses "24 seven, while I sleep, while I shower, all the time," that the brain will remap itself and adapt to thinking/processing at a 'network velocity' (see Kitchin 2014). In a way, Ben points out, the body already does this by filtering out the sound of a heart beating blood through the ears. "The fact that we don't already hear our pulses kind of astonishes me, and I think it kind of proves that your brain filters." He then wondered aloud, "If you're hearing depression more than happiness will you become depressed?" I thought to myself, is the Echo capable of creating a digital symphony of sympathy not just through the digital, but *for* the digital? Where are the limits of its sensory imaginary?

Ben fully acknowledged that this may not work as planned and it may be too annoying to handle. I also suggested that the introduced tones may themselves become tuned out, but as he pointed out, since they are digitally controlled he could possibly account for this with volume regulation. It seemed to me this was only doubling down on the potential for annoyance, but then he continued. "I'm hoping to gain an inherent sense of a hive mind of the emotions of everyone on Twitter. But the thing is, I'm doing the emotions thing more or less of a proof of concept to show people that you can learn data structures." Suddenly, it made sense to me. Ben

doesn't so much care about the Twitter emotion itself, but rather about probing the body to see how it's susceptible to having parts of the sensory network altered. Being attached to Twitter seems like an unbearable experience to me, but trying to understand the effects of the media infoglut is a prudent step towards implementing a full on BCI.

While most of Ben's applications for the Echo involved connecting networks and big data to the body, he has also conceived of it creating connections between people. "Imagine if you recorded your data and pushed it to somebody else. Could you induce certain physiological reactions? If you're used to hearing your pulse, you always hear your pulse every day, and then you start artificially bumping up people's pulses, will their actual pulse start to correlate with it? […] Can you imagine how fucking cool that would be if during a horror movie they falsely increase your heartrate in order to make you more scared?"

Ben isn't the only one thinking of applying this technology to elicit increased emotional response. Elaborating on his interest in connecting nervous systems, Evan imagined what would happen

> if you could completely record all the sensory information coming in from somebody's nerves and then you could then send it to another person. A simple example: instead of watching a movie you have all the scenes going. Instead of having a camera you've just got a person there, and then all their input information is recorded and then you plug in and you are in it instead of just watching it. That's something I like to think about. I think on a more useful level it could be help spread a little more empathy. Maybe you spend a couple hours walking around in fucking Kabul or something. You can get a little better idea of what other people go through in their day on a much more visceral level than just watching the news or something. I could see that as being actually useful on a societal level and not just a fun toy. (Evan)

It is in Evan's account that I think we begin to understand why information isn't 'close' enough for grinders. Despite modern media collapsing the globe into an immediately accessible stream of 'news,' there is no sensory depth to it. I noticed this in Jacob's account, too. Though he wasn't speaking specifically about the Beezy Echo, Jacob described the possibility of a similar device to sense "almost like global consciousness, like plugging into what humanity as a whole

feels." He offered the example of an electric collar that emits a shock when a police officer kills someone, or a belt that tightens based on the number of refugees crossing the border. Such "global level senses," as he described them, would leave the user "feeling that violence that our society is feeling, in your own body. […] Some days it would just be practically crushing you, and you could feel the despair and how much trouble there is in that place kind of based off of something that you would be feeling, personally." If such a device existed, Jacob said it would hold "far more attraction than an RFID chip" to him. On a more local level, Zac imagined feeling a loved one's heartbeat, where "if their heart rate elevates and they're under stress, you become aware of it instantly so you could reach out to them." It's not only about increasing connections for Evan, Jacob, or Zac, it's about finding new ways to embody what Boelstorff (2008) calls "fractal subjectivities" (p. 150). By eliminating the gap between themselves and events or people across the world, they enable the possibility of sharing multiple peoples' sensibilities (including their own) at once.

Lost in these desires for increased sensory connectivity is the materiality upon which such a platform would depend. Information does not jump straight from Kabul to a Beezy Echo; it has to pass through a global infrastructure. Information is always materially dependent (Jordan 2015), so to experience Kabul in real time would mean whatever recording devices are functioning and transmitting properly in Afghanistan, and, moreover, access to the internet is not evenly distributed (Qiu 2009). But even assuming there was physical and digital access, as Jordan (2015) and Galloway (2004) further remind us, the struggle to liberate an empathetic connection across the globe would be subject to the authoritative protocol necessary to make information *move* through the internet. Large technology companies already monitor data and metadata (that is, data about data, Kitchin 2014) passing through satellites, networks, and undersea cables (Jordan 2015), and data gathered for one purpose is sometimes found to have other uses, whether it be marketing, intelligence gathering, or predictive profiling (Andrejevic 2013; Kitchin 2014). This facilitates surveillance of not only *who* would be watching Kabul, but also *that* Kabul is being watched at all. Likewise, Zac's heartrate is suddenly being data-mined from the networks to end up in the hands of a private marketing company. Attempting to sense through the digital is grinders' goal, but the digital will also *sense back*.

Informational exploitation may be inevitable due to infrastructural hyperconnectivity, but Ben has also thought of another application for the Echo that would exploit the exploiters. While

others are imagining using his device to sense distant emotions and events, he is not as idealistic. In fact, he readily described the Echo's sensibilities as something he was trying to "falsify into a chip." But the data do not have to be 'true' to produce an effect. He gives an example:

> Could you imagine if you were […] writing an essay, and you had object character recognition on a camera that's watching you write, and you had different audio things in your head telling you if you were going in the right direction of what's right and credible, or, you're getting very close to plagiarism here. It's analogues. And it's like everything in the modern age is all digitals, you know? We want digital signals for stuff, but bodies are very analogue. So I could do gradients."

Computers can already read text, and universities already employ anti-plagiarism software that compares papers for similitude. But what is important in Ben's example is not so much the content of the essay, nor whether the plagiarism software is accurately identifying previously published work. Rather, what's important is the way Ben understands how the shortcomings of the digital electric eye can be used against it, or in other words, how its representations can be made productive by blending the digital and analog 'authors.' In Ben's example, he is simultaneously subjected to power relations (the surveillance of the plagiarism monitor), resisting those same power relations by modifying the text just outside of the definition of 'plagiarism,' and recursively reinforcing those power relations by submitting the paper for grading, and thus to the database against which future papers are compared, which ultimately becomes more efficient at disciplining, or 'training' subjects (see Foucault 1995, p. 170).

The instigated sensations of the Beezy Echo (i.e. bone conductive audio) are affective, in that they have a capacity for activation (Massumi 2002). By 'affect,' I do not necessarily mean emotion, but a post-social, pre-personal experience. It exists in the gap between content and personal effect (Massumi 2002, p. 24). If the Echo transmits that Twitter is sad, its vibrations will evoke an affective response for the implantee (i.e. Twitter is sad -> affective response -> 'I feel sad'). At the same time, however, the feelings are not affective since the design and coding of the Echo itself has pre-determined by its author's intention and signification via programming (see Massumi 2002). The personal effect has preceded the content (i.e. program the Echo -> Twitter is sad -> 'I feel this way because I programmed it to feel this way'). It is, paradoxically,

a pre-empted affect. It's like tickling your own feet – for some people it works, and others it doesn't. The user, via the Echo, bypasses the glut of analog information (e.g. reading a million tweets, counting refugees crossing a border, keeping constant watch over a loved one) through digitization, which enables it to modulate or manipulate the affect of its user by running in the background. Here we again see the logic of pre-emption, where the pre-discursive effects are dependent on the quasi-causality of affect, or, put another way, it is "the unceasing inviting of probabilities but not to predict the future" (Clough 2009, p. 53). The tweets, while not necessarily representative of an empirical event per se (that is, they do not represent "facts beyond themselves"), and though they are stripped of irony, tone, context, and critique, nonetheless have a "truthiness" that invokes a new form of sociality – a new capacity for action (Andrejevic 2013, pp. 46ff).

Mirowski (2002) writes that "cyborgs reveled in turning logical paradoxes into effective algorithms and computational architectures" (p. 23). The effects of the Echo are real if they are at least "felt to be real" (Massumi 2010, p. 53). In digitizing affect, it renders the user's affect like a computer – a probability of predetermined sensation – by extending the platform body into a hyperconnected sensory network.

Daemon Worshipper

Unlike the Beezy Echo, not a single grinder mentioned Diethyl's project in my interviews. Its idea and design were posted on biohack.me in 2015, where it also garnered little attention. I suspect the lack of interest may have stemmed from some combination of its lack of physical progress (no prototype has ever been built), that its functions were much less immediately achievable, and the fact that Diethyl had never met another grinder in person. I had a hard time finding him myself, as he lived in a small southeastern town of under 15,000 people in the United States. It took a few wrong turns before I guessed the highway that could breach the dense forest concealing the town, which took me past plantations with houses straight out of a period Civil War movie. Diethyl's project had caught my attention because, in contrast with the Beezy Echo, it was designed around subverting connections to others.

He calls it the *Daemon Worshipper*, a device he's been remotely working on with another grinder on the other side of the globe. 'Daemon' is a pun. In one meaning, it is an alternate spelling of 'demon' referring to a demigod, something intentionally provocative given how

"people are very religious and superstitious in this part of the country," he told me. Referring to even body modification in general, he said "you get kind of a negative reaction to a lot of this stuff here." In computing jargon, however, a 'daemon' is a program that runs as a background process. The computer daemon is not something a user will interact with, but is essential for the cooperation between hardware and networking. An appropriate name, I think, for what is to be a subdermally implantable open-ended general purpose computing system. The way Diethyl explained it, it seemed capable of anything. In fact, the reasons he gave me for *why* he was building it provided far more specificity about how the relationship between information and bodies needed to change.

The Daemon Worshipper was born of "political reasons" for Diethyl, and his description of how it works was interwoven with commentary on historical and current events. Our interview took place in the August before the election of Donald Trump, and Diethyl's apprehension about the political climate was palpable. I mentioned to him that earlier that afternoon I heard on the radio that Edward Snowden's Twitter account had broadcast what appeared to be a password. The commentators were speculating Snowdon had died or was assassinated, and this was perhaps a clue to finding further classified information leaks about the unauthorized spying apparatus of the National Security Agency. Diethyl hadn't heard about this, but he didn't seem surprised as he added his thoughts on the situation.

> Dissent's part of any healthy government. Any kind of government that stifles dissent is kind of borderline totalitarian. You know, they have friendly means of allowing for protest and dissent and stuff like that. We're not going to murder you in your sleep, we're not going to have the secret police come out and get you, but come out in the street, hold up some signs, we'll knock you over with water hoses, mace you, teargas you. Hey, at least you get to do this, right? So we just have his illusion of being able to have some kind of influence.

While he was telling me this, the Beatles' *Yesterday* was playing over the restaurant PA system. He didn't seem to notice, and continued.

> But in reality, anybody with too big a message or is doing a little too much, they get sent straight to prison or Guantanamo. I mean, I'm sure they would love to kill Snowden or send him to prison for life or Guantanamo or what have you. So [...] the tables can turn so fast, you know? What's legal one moment could be completely illegal the next. You might consider yourself a law abiding citizen and the next day you're a criminal just because the law changed, and so if we don't stand up for basic human rights and respect everyone's ideologies equally then that's something that could potentially happen. So a lot of that kind of thought was put into play when I was designing the [Daemon Worshipper] system. I was thinking, what if that happened to me? What if I became a political prisoner?

As an implant, Diethyl is designing both the Daemon's function and form to be "anti-surveillance type stuff, like I said, for political dissidence […]. Trafficking the right kind of information can have really great repercussions." The Daemon is intended to gain the element of surprise in a system where the movement of information is already omnipresent. As I understood it, it is designed to control which information is sensible to whom.

To begin, like other subdermal implants the Daemon is both easy to conceal and hard to take away. While Diethyl continues to research hardware and wait for chip prices and sizes to decrease, he has already diagrammed the ideal inputs/outputs required for his application, including Bluetooth and bone conducting audio. What makes the Daemon unique is it is designed around a field-programmable gate array (FPGA). The FPGA, he explains to me, is an integrated circuit (IC) that can be programmed, whereas most ICs are not user-changeable. As Diethyl described it, the FPGA is capable of emulating hardware, which in his words means "you're physically creating hardware based off of software code." It is meant to be a meta-platform that designs and manipulates its own boundaries. As such, it is not subject to established protocols for interacting with other electronic devices, but it could still do so when necessary. This would allow the programmer to determine who has access to whom by modulating the protocol logic of absolute 'connection or no connection' (see Galloway 2004, pp. 74-75; Jordan 2015, pp. 69-70). With an FPGA, it would be possible to program multiple architectures, or reprogram various hardware interfaces. This makes it further possible to adopt a

modular system, meaning different virtualized hardware can be implemented based on individual needs. Like I said, it seems capable of anything.

With no prototype, it remains to be seen how this plays out. What is important, however, is that the Daemon Worshipper is a reaction to the constraints of hidden power structures animated by digital protocols. For example, Diethyl explained to me how secure communication could instead be established by "exchanging encryption keys via physical handshake whereupon keys are read from RFID implants." The physical, in-person exchange precludes a network from detecting who is connecting to whom. As I understanding it, this is unlike a VivoKey in that it is not securing personal/digital identity for the use with established institutions, but rather it secures a means of encrypted communication between two (or more) people who can set up their own protocol. This would make possible what Diethyl called a 'cyborg detector' that scans for beacons "sent at set intervals while a cyborg is on the grid," but excluding anyone else from intercepting meaningful communication. Just as Amal described a digital identity that is overlaid with an analog reality, Diethyl is imagining a multilayered digital realm where each digital channel can be rendered sensible or insensible as the political situation calls for it.

The digital layers are, of course, still highly connected to the analog body. Of all the possibilities afforded by the Daemon Worshipper, the one that most intrigued me was what Diethyl called the 'deadman switch.' The switch is triggered when internal body temperature drops below a threshold, indicating the user is dead. At this point, it will begin transmitting messages over every available protocol, including SMS (text messaging), GMS (global messaging system), and/or other networks (e.g. Wi-Fi, Bluetooth). The message can trigger a script to inform next of kin of the death, send the last will and testimony to a lawyer, or delineate instructions for body disposal or cryopreservation. Most importantly, perhaps, it can also direct their private network to clear browser history, wipe disk drives clean, and otherwise cause system self-destruction. Thus, when the analog body dies, so too would its digital counterpart. Their abilities to sense and be sensed are intertwined.

The Daemon Worshipper as imagined by Diethyl is a BCI that would allow him to exclude who he wanted to exclude, both in life and in death. It would also let him use existing internet infrastructure when it was convenient, but employ his own security protocols. A secret dissident sometimes, but legitimate when necessary.

Conclusion

The Beezy Echo and the Daemon Worshipper offer real-time remixes of biodigital bodies (see O'Riordan 2011). A device like the Echo imagines embodying public (e.g. tweets) and private (e.g. a loved one's heart rate) information as it moves through internet infrastructure, and it also imagines simultaneously exploiting and contributing to existing informational movements (e.g. plagiarism detectors). The Daemon imagines embodying public and private networks with other cyborgs, and being able to choose what is sensible to others. In each, bodies are broken down into code and distributed, and BCIs put them back together as an affect, a surveillant, a partner, an author, a dissident.

In the opening quotation, Baudrillard lamented that the "worst thing that can happen to an individual is to know too much and, thus, to fall beyond knowledge." How do grinders' BCIs materially reconfigure the relationship between individuality, information, and knowledge? I suggest that the Beezy Echo and the Daemon Worshipper platforms can be theorized as a practice of sensibility that emphasizes the position of the body and its senses not as an individual, but rather as a *dividual.* Deleuze (1992) defines a dividual as a subject formed by fracturing the individual into samples, data, or markets, which is then reformed into new combinations to facilitate or deny access to information. It is a defining feature of societies of control, where people are reduced to "a bundle of aptitudes or capacities […] that can be analysed and exploited for commercial, governmental or other ends" (Patton 2010, p. 96). A dividual is "not part of a mass, but a series of masses" (Colwell 1996, p. 212). Grinders' BCI devices may not yet exist in a useable form, but what is significant is that they are already *thinking as dividuals* and governing themselves accordingly. In contrast with biopolitics of the self as defined by discourses of, for example, health (e.g. Foucault 1972) or molecular politics of risk (e.g. Rose 2007), the self is now no longer *an* individual but a *collective* of dividuals, of fragmented identities. To fall beyond knowledge may be the worst thing for an *individual*, but it might be necessary for *dividuals* to adapt to infoglut.

Efficiency once again drives most of the BCI's applications conceived by grinders. A biological mind is not fast enough to keep up with an accelerated society and the speed of networked information, and so grinders imagine neural interfaces made possible by BCIs that can stack sensory networks to direct, or redirect the movement of information in beneficial ways. Knowledge is replaced with *now*ledge, that is, information that is available for production immediately. The Beezy Echo makes it possible for a person to embody multiple dividuals at

once, pre-empting the user's affect according to predefined conditions. Control over the body is achieved by acting through the virtual dividual (i.e. the BCI's code), or what Bogard (2006) calls "proactive normalization" (p. 106). According to Poster and Savat (2009), "dividuality is the effect and experience of on the one hand being made into a form, an essence, a solid state, and on the other hand being made into a flow, an event, a fluid or formless state. Dividuality is precisely the experience of being neither this nor that, while at the same time perhaps being both at the same time" (pp. 58-59).

As Colwell (1996) observes, the mode of dividuals thus creates the problem of eliminating space for political action, as identities are picked up and dropped as a means of economic, social, and political survival. After all, the Daemon Worshipper kills digital identity when the body dies, but that digital identity remains alive until that point is reached. It does not challenge existing political systems so much as keep them 'alive' when it is convenient. As an informational battleground, then, grinders' BCIs offer individual flexibility while nonetheless supporting a rigid structure.

Chapter Nine
Conclusion

Warren Ellis' *Doktor Sleepless* was cancelled after just 13 issues. The titular character had declared himself the villain, but the effects of his actions or how the technologically enhanced grinders would play a role remains incomplete. What was achieved in its short run, however, is the world-building that emphasized the inevitability of technologically enhanced humans and the effects of asymmetrical sensibility. In my interview with Evan, he told me what he liked about Ellis' work in general (and especially *Transmetropolitan*, another near-future dystopian tale featuring a hyper-competent techno-protagonist):

> Whenever I get optimistic about the singularity or automation, I think it's good to take a look at something like that and it's like, well, you can have all this stuff [but] people are still people at the end of the day. And that's what I really like about that comic is you've got all this fantastical technology […] to the point that even you as a reader just stop noticing it at a certain point. 'Oh, yeah, sure, he's got a pair of glasses that are more powerful than an iPhone' and all this stuff, but people are still shitty to each other or not, you know?

How do grinders make sense? This question was examined on four interwoven layers, but as much as this dissertation centred around new technological interventions into the body, the answers often involved how old technologies that have faded into the background affect the relationships between grinders and beyond.

The first layer of making sense considered how grinders make sense of the world such that their bodies ought to become enhanced by setting out the social, discursive, and material conditions necessary for the practice grinding to emerge. Grinders go to great lengths to determine the vulnerability of their bodies. On one hand, they draw from scientific data, medical reports, emerging technologies, and the odd conspiracy theory to probe corporeal weaknesses. These perceived weaknesses were especially acute given the uncertain political climate at the time of my interviews, as well as concerns about an increasingly hazardous environmental climate. These hazards are perceived as beyond reparation and unsolvable, so the only response

is to adapt the individual to the problem. Sometimes, identifying vulnerabilities meant risking their health to understand and push the limits of the body. I described this effort as a logic of pre-emption, where grinders "turn the objectively indeterminate cause into an actual effect" in order to create a point of intervention for enhancement (Massumi 2015a, p. 13).

On the other hand, grinders can't rely on most traditional sources of knowledge. Scientific data (especially biotech) is fraught with falsified or unclear research, official medical channels are only interested in returning the body to 'normal' capabilities, and established large transhumanist groups seem content to wait around for something to happen. This leaves grinders to sort out the woo (misleading information) from wu (excessive information that must be tested). Nor are commercial corporations, with their risk aversion and penchant for planned obsolescence, acceptable for producing anything that might be implanted in the body.

Thus, both problems and solutions of the body are reduced to grinders' individual capacities. In short, nobody else has their personal enhanced body at interest, and so grinders must resort to DIY. The grinder scene, as loosely as it is defined, developed out of an interest to make technological enhancement widely available. Even though grinders are somewhat privileged, they want to promote widespread practises of body autonomy. However, grinders' logic of pre-emption enacts some of the very concerns that they hoped to avoid. First, and most immediately, in trying to create the enhanced, robust body of the future they risk the health of their present bodies. Second, grinding ironically creates more knowledge that others either have to blindly trust or test themselves. Trying to share or sell devices in the 'shadow of the law' means withholding information, whether it be related to manufacturing techniques or avoidance of liability. Particularly for those not able to meet in real life, the quality of any product must be questioned. In short, grinding perpetuates some of the same old corporeal and institutional problems of knowledge circulation that prompted grinding to emerge in the first place.

The second layer of sense-making refers to the physical development of constructing a sensory device – the brainstorming, designing, and building. Though many of grinders' projects involve exaggerating a sense (e.g. increasing visual range), I focused on those which featured novel enactments of sensory assemblages. When grinders think of social problems as modifications of sensory assemblages, they consider the relationship between a body's sensibility and that which it senses. Doing so brings out the different interrelated dimensions of senses, such as space, velocity, interrelation between senses, sensory organizations of

knowledge, and processes of exteriorization/interiorization. Grinders imagine ways modifying sensibility itself by altering the depth of some of these dimensions, such as trust via oxytocin, social relationships via MK-801, instant knowledge ('nowledge') via a BCI, memory/identification via RFID, and electromagnetic information via magnet implants.

Designing and building implants involves modifying the material substrate of the sensory network right at its corporeal limits. All implants need to have bioproof coatings that are compatible and appropriate for the application. Experiments require inserting, waiting, and cutting out numerous iterations to test the implant's efficacy. It is here the physical body takes centre stage as it reminds grinders, with rejections and pain and scars, that something can be inserted into the body but it still needs to be separate from the body. Accompanying these reminders are the social considerations about visibility and lifestyle choices that also interfere with embedded technology. There are impediments to getting implants, such as the need to look employable, avoiding religious condemnation, or having a job that requires vigorous use of the hands. Adding biomechatronic parts does not make the body any less organic nor any less social.

The designing of digitally mediated senses requires decisions to be made about both what should be sensed, and how it should feel. These devices allow the user to go into the world to find new discoveries, such as which locations or objects are radioactive. Alternatively, they can be used to bring sensations from the world directly to the user. In either case, the new sensibility is reduced to a pre-determined range of sensation. Ultimately, the development layer of sense-making involves new applications of technology, though the form it takes largely depends on the limitations of regular bodies and familiar social structures.

The third layer of sense-making involves grinders using their newfound abilities to render their world sensible or, in some cases, insensible. Magnetic implants sensed electromagnetic properties of everyday objects, featuring diverse sensations described with colourful language. This ability had practical applications, such as diagnosing electronic equipment, and it also uncovered lost or hidden social histories of objects, like surveillance mechanisms and abandoned T-coil messages. At the same time, magnet implants demonstrated some of the effects of asymmetrical sensory abilities, where one population has disproportional access to information that can be used for exploitation. Here, the grinder again creates an inability to discern woo from

wu for non-implantees. Magnets enact complex sensory assemblages, but they also separate those who can sense from those who cannot.

I further argued that the RFID is a cyb/organ that enacts a sense of digital identification. This, too, is programmed so that objects are recognized by the body and vice-versa. However, for this sense to work it has to adhere to protocols, which can require being locked in to certain brands or even lifestyles. The Vivokey locks in digital identity, and in doing so interiorizes and stabilizes any accounts it is attached to (e.g. corporations, nationality), by guaranteeing the source of information. Though the Daemon Worshipper has not been built, it is conceived as being able to render these types of connections sensible or insensible as the user desires.

The fourth layer refers to grinders enacting biopolitical assemblages that extend well beyond the implant or its immediate use, but reflect back onto grinders. To begin, despite their DIY and open-source intentions for enhancing bodies, grinders reaffirm the authority of external parties. As demand for quality and consistency grew, Grindhouse began outsourcing their circuit-making and coating procedures. The body modification scene is also relied on for implanting their Northstar implant. Grindhouse's decisions reduce their risk of liability and increase the safety for their customers. At the same time, this also reduces other grinders' ability to DIY by obscuring aspects of the manufacturing processes and discourages self-experimentation, essentially making the grinder scene subservient to these other providers of expertise. Grindhouse is only one example (they are merely easiest to identify given their organization), and many other grinders also withheld information to prevent naïve would-be DIYers from making 'dumb' or dangerous mistakes that would undermine the scene's credibility. When it comes to modifying bodies, discourses of legal and health risks are still paramount.

Grinders often asserted their modest projects are stepping stones towards something bigger, like neural interfaces or body replacement. But so far, what else are they stepping stones towards? The most significant biopolitical assemblage that grinders reinforce, I argue, is digital infrastructure. McLuhan demonstrated that modifying senses can change how knowledge is organized. Grinders' devices, however, suggest that they are instead reorganizing their bodies to adapt to the internet as an instantaneous repository of knowledge (or at least *nowledge*). Just as clocks colonized the productivity of bodies of the modern period, digital connectivity characterized by the internet now takes over for late modernity. Where grinders change

themselves, the broader organization of knowledge thus remains mostly the same, and therefore so, too, do the power structures that animate it.

In the bottlenose, RFIDs, the Vivokey, and BCIs, life is defined by the protocols and speed of the internet's turbocapitalism. Through these devices grinders embody dividuals, caught up in constant modulation. It is on and through dividuals that power is exercised by not only by grinders themselves (e.g. designing affect with the Beezy Echo), but also by the institutions and corporations identifying them (e.g. a Samsung RFID door lock, a bank securing a financial transaction with a Vivokey). Deleuze (1992) argues dividuals are a defining aspect of a *society of control*, where freedom is marked by responsibilities. Grinders could program a BCI to do anything, but the vast majority of their applications involved tracking or surveilling others and themselves to make the body into a hyper-efficient processor of information. The most poignant example is the simple RFID implant, which represents never forgetting your keys, and always remembering which devices it can connect to.

But where dividuals make possible fragmented identities for navigating a society of control, Deleuze (1992) further notes how this movement is based on rivalry, an "excellent motivational force that opposes individuals against one another and runs through each, dividing each within" (p. 5). Reflecting back on previous chapters, we can see this has been the case all along in the grinder scene. In chapter three, grinders rejected educational institutions, instead engaging in the "perpetual training" (Deleuze 1992) required to know all that is needed for modifying bodies, from biology, electronics, engineering, chemistry, genetics, and so on. What this training affords grinders is the ability to set themselves apart from 'non-enhanced' bodies, who are left unable to decipher wu from woo, as was demonstrated with magnet implants in chapter six. Maybe someday grinding will undermine the possibility of sexism or racism through voluntarily polymorphous bodies, but it would be replaced by a technism against those without the skills to, for example, get their RFID tag connected to their phone. This is, I suggest, not so much changing bodies to transcend humanity, but instead making change more difficult by securing memory into chips, and banks into bodies. The grinder body is enhanced to adapt to a society of control.

However, as Haraway (1991) suggested, literacy has historically functioned as a path not just towards assimilation but also resistance. In their hybrid positive/constructionist mode of thinking, grinders' technological literacy may create the conditions necessary for subjecting the

body to the digital flow of capital, but this also creates a ‘scrapheap’ from which different bodies can be scavenged. As was shown in chapter four, not everything ends up in the digital realm. Grindfests, or places like them, still exist as a location for discovering mutual vulnerabilities, for finding new affinities, for making new kinds of sense.

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