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Because My Garmin Told Me To: A New Materialist Study of Agency and Wearable Technology

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A New Materialist Study of Agency and Wearable Technology

By

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Dedication

For Pop Pops. From the very beginning you taught us to shoot for the stars and then gave us the love, support, and courage to do so. This is for you.

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Abstract

Wearable technologies are being adopted in increasing numbers and the market space appears poised for continued growth in virtually all areas, from medicine, to self-quantification, to sports. While the overwhelming majority of work on wearables has been done on their medical applications and their role in shaping identity, this dissertation examines the roles that wearable technologies play on the decision-making processes in athletic contexts. Using new materialism and Actor Network Theory as lenses, I attempt to break from the Cartesian model that places human subjectivity and intentionality at the center of a rhetorical situation and, rather, allow that non-human actants are agentive. I examine the interactions that age-group triathletes have with their wearable technologies and the shifting agencies that accompany those interactions. These interactions call on disparate human and non-human actors in forming a series of temporary, shifting networks that utilize a distributed agency in the decision making process.

Chapter 1. Wearable Technologies, New Materialism, and a Decentering of Human Subjectivity

Why Wearables?

Over the course of the past decade, wearable technology and personal fitness tracking devices have increasingly made their way into mainstream lived experiences. These devices have moved from the stuff of science fiction movies to increasingly common presences in the daily lives of many people. Wearables are beginning to establish themselves as a stable, mature market. Increased visibility and widespread adoption rates are indications that these devices and technologies are very much in the public consciousness and that they are increasingly being interwoven into the infrastructure that helps us to make sense of our lives and interact with our worlds (Johnson and Johnson, 2016). Additionally, while we see these devices in increasingly greater numbers, they are being used in the spaces that rely upon physical performance as measures of success. In sporting realms, for example, wearable technologies have been used to gain a competitive edge and push the boundaries of athletic potential. Kieran Loftus, the director for Puzzle Sports, says, "Wearable technology has become heavily ingrained into professional sports, allowing adverse metrics to be taken into account and utilized within training and allowing for real-time decisions to be made subsequently" (Loftus, 2016). In an ever-increasing way, people are turning to wearable devices for guidance and insight into the choices that they make.

As wearable fitness technologies continue to proliferate into the fabric of our daily lives, users increasingly depend upon them to make sense of their everyday place and praxis. Given that these technologies are, relatively speaking, just now reaching maturity, it is important that our interactions with them be scrutinized. Rhetorical investigation into our relations with these technologies and their design can influence the manner in which we engage with them and shape future development. It is equally important that, rather than focusing our gaze solely on the manner in which we integrate these devices into our lives, attention is paid to the impact that they have on us. Seen through the lens of new materialist theory, wearable fitness technologies have agentive power and disrupt the subject/object relationship. This project serves as a step in developing rhetorical theory as it addresses the connections between human and non-human actors and explores the interactions between humans and technology more broadly.

A Case Study: KOM Hunting

At the end of 2016, cyclist Phil Gaimon retired from professional bike racing. As a longtime proponent of clean racing in cycling[1], Gaimon initially dedicated much of his newly found free time to going after the Strava[2] records of known dopers in his local area. These efforts gained fairly widespread notice, which he then parlayed

[1] It is widely accepted that performance-enhancing drugs are an endemic plague on professional cycling, especially since Lance Armstrong admitted to doping on 1/17/13. Since then, cycling has worked hard to restore its image as a clean sport. Gaimon was one of the more vocal members of this group, going so far as to tattoo the word "clean" on his arm.

[2] Strava is a widely popular social network for cyclists and runners that tracks activities via GPS. Workouts provide information such as pace, heart rate, elevation, etc. based on the metrics that are captured with various wearable technologies

into a recurring show on YouTube that he named Phil Gaimon's "Worst Retirement Ever." Though he abandoned his original mission to take the KOM's[3] of known dopers, Gaimon's mission on the show stayed consistent. His goal in each episode was to capture Strava KOM's on notable hill climb segments.

The first season of the "Worst Retirement Ever" was ten episodes in total. In each episode Gaimon adopts his signature goofy attitude towards his goals, playing his attempts off as frivolous. He frames his attempts as silly, amateurish hijinks, as something that pros simply don't care about. "The thing is, if you're a pro, like I just know that Chris Horner doesn't care about his Palomar Strava… Ian Boswell was stoked when I took his baldy segment. Like, it's fun… but this is all I have left" (Episode 1, Palomar). However, as much as Gaimon tries to portray his attempts as foolish and petty, it quickly becomes clear that his goals, these virtual awards, do matter quite a bit to him. Though Gaimon attempts to frame his actions as silly and insignificant, they are very clearly serious enough for him to subject himself to the rigors of significant training and profoundly difficult physical acts. They exert an undeniable impact on him, emotionally and physically.

> It's really tough to admit this, but from when I uploaded the file and I didn't know if I had it … I care. Like, I can't believe I care and it sucked to not get it and I just didn't think that any of this… I thought that this would be fun and entertaining. I didn't think it would move my emotional needle, but it did. (Episode 2: Mt. Diablo)

[3] KOM stands for King of the Mountain. In this context, it is a virtual award given to a cyclist who posts the fastest time across a predetermined segment in the Strava app. The origin of the term KOM originates from the sport of cycling, given to the rider with the fastest time through the mountain segments of stage races. For women, the term QOM, Queen of the Mountain, is used.

Gaimon's reliance on wearable technologies is clearly evident in virtually all aspects of his show. Though he calls very little attention to their roles directly, it is clear that he uses these devices in his planning, execution, and evaluation of his efforts. Ultimately, they determine his success or failure. Their use underpins everything, providing the platform upon which all of his efforts and assessments are carried out and the basis against which they are evaluated. In planning his effort, he refers to his power outputs measured over time, utilizing a power meter, altimeter, and GPS on his bicycle. "410 watts, kind of the first third, and then the flat parts save a little bit and try to recover and then blast the end. I think it's like 11 miles total" (Episode 1, Palomar). He uses GPS and a timer in the actual attempt. "I kind of paced it thinking like a really good day would be 53's, 52's" (Episode 3: Mt. Lemmon), and then laments his hesitation based on his perception of the data he saw on the devices. And, finally, upon completion of his attempt, he bemoans the inability of his bike computer (which he then comes to realize is, in fact, a limitation of his own technological savvy, as the device can, in fact, do what he cannot by telling him exactly where the segment begins and ends) to guide him farther or more exactly to the finish line.

> The annoying thing about any of this stuff is that, like, I time myself so I kind of know what time I did but I don't know where the segment starts […] You drive down to where you can find cell reception and you set up your personal hotspot and then you upload (Episode 1: Palomar)

Here, Gaimon is saying, in essence, that he was poorly directed by the computer. That, had the computer given him more information at an opportune

time, he would have behaved differently and that the outcome would have been more to his satisfaction. This is a de facto way of expressing joint culpability in failing to capture his goal of being the fastest person up the hill, or, the virtual title of "King of the Mountain," -- KOM. Nowhere does he specifically blame the device as the reason for his failure. Gaimon does not attempt to frame it as an equipment failure in the vein of a flat tire or bike issue. Rather, it is a cognitive, emotional, shortcoming. For Gaimon, the physical effort stands as it does. It's the intellectual efforts – the choices made and the contextual understanding – the confluence of time and speed and distance – what Aristotle refers to as Kairos, that fails him.

Ultimately, the KOM's and Strava leaderboards exist as a collection of pixels on computer screens that result from a series of data points collected, algorithmically processed, and then displayed on devices worn or attached to his body and bicycle. Despite their abstract and seemingly inert nature, they are impactful, asserting agency and directly affecting Gaimon's decision-making process, both in and out of training. On the simplest of levels, these devices and the data they present set both starting and finishing lines, as well as instructions on how to move from one to the other. Gaimon begins at the bottom of the hill with a timer set at 0:00. As he travels up the hill, towards his goal, the timer ticks forward and his computer measures distance and time until he reaches his digital end point, past which, none of the metrics matter to him anymore. Along the way he is provided data that explain what he is doing. Though the physical effort is his, the explanation and interpretation of that effort is not. The completion of a segment defines a

finishing line that, once completed, signals the end of his attempt and directs him to focus elsewhere.

In the event that someone "takes" a KOM from him, Gaimon does, on occasion return to the segment. "The Stunt was one of the earlier climbs that I got […] I got it, checked it off the list, and then forgot about it. And then, this guy […] took my Strava […] and I'm going to try to take it back" (Trolling on Stunt Climb, 4/6/18). Playful for the camera or not, there is a clear tone in his voice that he is annoyed and a very real sense that he does genuinely want his Strava title back. None of these emotional or physical responses are possible without the technology that defines the segment, the efforts, or the results and provokes the emotional stimuli that in turn motivate him to return to a segment that he had, by his own admission, forgotten about. It's clear that a combination of human and nonhuman actants play roles determining both Gaimon's thinking and behavior.

The worn ecology of GPS computers, speed and cadence sensors, power meters, heart rate monitors, etc. not only directs Gaimon's actions, steers his efforts, and triggers a range of emotional responses (joy/relief when he does take a KOM, frustration/anger when he fails to), it lingers, asserting itself in tangible ways. "Palomar, I have regrets. Palomar bothers me. Palomar… I've lost sleep over Palomar and I will continue to do so" (Episode 2, Mt. Diablo). It would be shortsighted to misconstrue a lack of consciousness on behalf of the technological ecology for a lack of agency, which simply refers to an actant's ability to impact the ecology of which they are a part. In the moment that Gaimon laments his failure to take Palomar, shows annoyance at losing the Stunt Strava, or joy at capturing the Mt.

Lemmon, he confirms what has long been accepted by New Materialist theory: nonhuman objects must be considered as active participants in the ecologies to which they belong. The worn devices influence decision-making, asserting themselves in ways that are often larger than the purpose they are intended to fulfill. They provoke emotional responses, shape our evaluations and judgments and modify our actions. Lupton, (2017) coins the term "data sense," which she argues, "involves entanglements of human senses and digital sensors with sense making. This approach underlines the embodied, affective and material nature of engaging with and learning from data" (pp. 1603-4). Lupton argues, and the Gaimon example makes clear, that data are not inert "things" that serve a singular purpose for human subjects. Rather, they are interactive, both informing and directing. These devices provide data that fill in for bodily sensations that are unavailable, providing insight and guidance that is not otherwise accessible to human actors despite the fact that they are the source. Lupton (2016a) continues by saying that athletes

> Talked about not really 'knowing' how their bodies were responding the exercise until they glanced at their heart rate monitor while running or cycling or reviewed their data after their exercise. These data were often viewed as more 'truthful' or 'accurate' than the haptic and other sensations they felt from their bodies as they were exercising. To many people the data visualizations generated from their personal information is sometimes more 'real' to them than the knowledge that their bodily sensations provide (p. 7)

Rather than existing simply as some sort of digital mirror into human performance, wearable technologies become vital participants in the process itself. They are generative of information that exists beyond physical sensation alone and are capable of influencing the decision-making processes. Neff and Nafus (2016) state that

> When people elicit sensations through tracking, they shuttle between observing physical signals felt in the body and observing the recordings of them. Working between the two, they better define or feel a phenomenon. The data becomes a "prosthetic of feeling," something to help us sense our bodies or the world around us" (p. 75)

The degree of the influence exerted by wearable technologies is largely contextually based and the result of the interactions among technological actants, human actors, and countless other analog nonhuman actants that make up any particular scenario.

Decentering: Making Space for Non-Human Actors

One of the aims of this dissertation is to decenter the human actors in these networks to gain an increased understanding of the potential of nonhuman things to assert themselves. Doing so allows us to understand not just who and what is involved in a network, but also the transactions and byproducts that result among them. New materialism and Actor-Network Theory (ANT) provide useful heuristics for stepping outside a traditional paradigm dominated by subject/object relationships that privilege human actors as the source and will of action. ANT

argues that both humans and nonhumans can be understood within a network wherein their identity is defined through their interaction with other actors (Cressman, 2009, pp. 3-4). Rather than accepting the hierarchical subject/object relationship as the de facto state of affairs, ANT allows us to shift the view of relations from a vertical one with the subject at the top to a horizontal one that looks at the interactions of its actors. This is what Bruno Latour (2005) refers to as an ontological "flatland" in which all actants have agency. The network becomes the object of study rather than a privileged position with it.

It is important, though, that we remember that the aim of decentering the human subject is not a doing-away-with any more than it is a carte blanch acceptance of the human's actant participation in a network. The aim, rather, is to better understand the coming together, the confluence of human and nonhuman. It's far too easy to zealously accept an approach such as new materialism and forget about the human component of the very relationships we seek to address. Melonocon reminds us that "Speaking of not forgetting the living, breathing body, technical communication is almost guilty of that very thing. The field has too long assumed an unproblematic and disembodied body" (p. 69). She continues, by citing Hayles (1999), arguing that the idea of embodiment "is contextual, enmeshed within specifics of place, times, physiology, and culture, which together compose enactment," and it is "akin to articulation in that it is inherently performative, subject to individual enactments" (Hayles, 1999, pp. 196–197). A new materialist lens requires that we account for the impacts of context. As such, we cannot rightly

make claims about wearable technologies without understanding the circumstances under which we engage with them.

Diving deeper, beyond a human-centered hierarchy of action requires that we restructure notions of the participants in an ecology and their ability to impact its boundaries. As Jane Bennett (2009) says, "The task becomes to identify the contours of the swarm, and the kind of relations that obtain between its bits… this understanding of agency does not deny the existence of that thrust called intentionality, but it does see it as less definitive of outcomes" (p. 32). As Bennett argues, understanding the swarm is made easier by looking at the configurations of human and nonhuman entities of which it is comprised. Actor-Network Theory allows us to do this by imbuing all participants, actants in the networks with agency. Latour (1996, p. 373) states

> An 'actor' in ANT is a semiotic definition -an actant-, that is, something that acts or to which activity is granted by others. It implies no special motivation of human individual actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action.

Through this lens it is possible to engage with the various actors of the network, not as objects manipulated by self-determining subjects but, rather, as co-participants in a larger, more vibrant assemblage.

In the ecology surrounding the Gaimon example, the most immediately visible actant is Gaimon himself. However, as a starting point, we need to focus more of our energies on understanding the interplay between him, his bicycle, and the computers and sensors attached to both of them as well. There are multiple

actors at work simultaneously here. "An actor-network is simultaneously an actor whose activity is networking heterogeneous elements and a network that is able to redefine and transform what it is made of" (Callon 1987, p. 93). These heterogeneous elements are, doubtless, too many to count. However, we can certainly count among them the data that are produced and tracked by the interplay of human and nonhuman actants involved in the wearing and use of wearable technology, as well as the results of their interactions, whether they be the formation of identities or emotions.

This notion of multiple human and nonhuman actors concurrently affecting and shaping the dynamics of the network is what Jane Bennett (2009) understands as vitality, or, "the capacity of things—edibles, commodities, storms, metals—not only to impede or block the will and designs of humans, but also to act as quasi agents or forces with trajectories, propensities, or tendencies of their own" (p. viii) and refers to her conception of distributed agency, which "does not posit a subject as the root cause of an effect" (p. 31). Rather, she allows that any aspect of the network (what she refers to as assemblages) has the ability to shape and (co-)determine the direction, development, and eventual outcomes of a given endeavor. Appreciating the agency of things to act in what Latour (2001) calls a "collection of humans and non-humans" (p. 174) expands our understanding of action, our relationship to technology and the rhetorical power of non-human objects. As wearable technologies become more ubiquitous, they constitute more and more of what Thomas Rickert calls the "ambient rhetoric" in which we live, act and work out our identity.

Wearables: Technology by Many Names

Before proceeding too much farther it is first necessary to outline what is generally meant by the term "wearable technology" and then, to further refine this understanding to enable a discussion that applies to an athletic context. Generally, the term "wearable" refers to any electronic technology that can be comfortably worn on the body. "[Wearable Technology] ranges from e-fashion, smart materials, wearable electronics, solar energy and 3D printing to bio-culture and nanotechnology" (Smelik, p. 456). In short, when we refer to wearable technology what we are identifying are electronic technologies that are attached to the body in a relatively unobtrusive way. The purpose of these technologies varies according to intent but often the intention is to "control, improve and enhance human lives and bodies" (Smelik, p. 456). Our interactions with wearable technologies take place in many contexts, which are continually expanding. Currently, wearables exert a strong presence in medical fields, professional and amateur athletics, and law enforcement, to name but just a few. In virtually all cases, the nature of the devices is going to be determined by the activities being performed. While the illusion of homogeneity is strong and the feature list among devices may appear largely redundant, wearable technologies are often purpose driven. The most visible (and general) of these devices belong to a classification commonly referred to as activity trackers.

These devices, such as products by Fit Bit or Garmin, are a class of wearables that harvest data from multiple sensors (accelerometers, Global Positioning

> System [GPS] chips, and heart rate monitors) to track a range of bodily metrics related to exercise, like steps taken or calories burned" (Gouge and Jones, p. 200)

These devices are not limited to any particular activity or purpose and, given myriad medical and wellness applications, can be applied and worn anywhere on or in the body in the form of pacemakers, artificial valves, joints, and even, animatronic limbs to name a few. However, the most common version of what we associate with wearable technology generally takes the form of a small band or watch worn on the wrist or chest. In addition to reporting the time of day, these devices often relay metrics such as one's heart rate, levels of physical activity, hours and quality of sleep, among others.

The range of what wearable technologies are used to measure and track in athletic contexts becomes broader as the equipment utilized becomes more specialized. For example, NCAA football programs have been exploring the potential of wearable technology by implanting sensors into helmets and pads to monitor the physiological status of athletes (Tracy, 2016). Similar steps have been taken with the women's national soccer team. Given the broad spectrum of capability and the increasingly diverse number of options available, activity trackers are often used by professional and amateur athletes alike to track their performances and are suitable for a vast array of use scenarios.

The term wearable technology is so broad that, without adequate context, it is difficult to understand what, exactly, it refers to. Piweki, Ellis, Andrews and Joinson (2016) state "one in six (15%) consumers in the United States currently

uses wearable technology, including smartwatches or fitness bands. While 19 million fitness devices are likely to be sold this year, that number is predicted to grow to 110 million in 2018" (p. 1). The term "wearable" simply covers too broad a spectrum of use to have an inherent meaning simply being non-biological. Even that distinction is quickly fading. As such, it would be a mistake to try to account for them all at the same time or through the same lens. Their points of engagement are different, as are the abilities of human actants to make sense of their data. Wearables utilized by health professionals or in hospitals are profoundly different than a Fitbit used by a recreational jogger, which is, again, very different than the power meter that Phil Gaimon uses as he attempts to capture KOM's. These differences lie largely in the manner in which human actors interface with the devices and the degree to which they are able to interpret the resultant data. None of this is to suggest any sort of value system or hierarchizing attempt. Rather, I want to make clear that each interaction between human and nonhuman actants must be contextually framed if we are to gain insight into the value that wearable technologies can add.

Despite the apparent similarities across a number of devices, the ways in which human and nonhuman actants engage heavily impacts the manner in which a device is going to be able to perform as an active participant in an ecological system. The use of screens, haptic feedback, and audio prompts invites meaningful interaction between human and nonhuman participants. Additionally, in order to (re)act accordingly, human agents must be able to make decisions based on the data they receive just as the devices act on the data that they receive. In other words,

meaningful, productive exchange between the human and nonhuman agents must be coherent and interactive. The distinction between the simple act of recording and presenting data and the coauthoring of decision making as a result of data is, perhaps, best elucidated through Latour's (2004) use of propositions. He says

> I have acquired the habit of using the word propositions to describe what is articulated. The word 'proposition' conjugates three crucial elements: (a) it denotes obstinacy (position), that (b) has no definitive authority (it is a pro-position only) and (c) it may accept negotiating itself into a com-position without losing its solidity" (p. 212)

Latour's propositions position both user and device as parts of the sense-making ecology that wearables provide. However, in doing so does not posit a subject/object relationship between the human and nonhuman agents; as he says, there is no definitive authority. There is negotiation. As applied to wearable technologies, this negotiation is a co-constructive approach to meaning making. However, given the established breadth of what the term wearable can mean, it is first necessary to specify an ecological context if we are to productively apply Latour's propositions to wearable technologies.

The sport of triathlon is comprised of three separate phases: swim, bike, and run, each of which provides productive opportunities to study the application and engagement with wearable technologies due to the incredibly data-centric nature of the sport. Each of the three disciplines of triathlon uses sport-specific metrics to measure progress, often requiring unique technologies for the measurement and quantification of progress. Additionally, given the physical limitations imposed by

the three distinct phases of the sport, swimming, biking, and running, constraints are imposed on nature of engagement with the devices themselves. These varied circumstances each offer a multitude of ways to collect, splice, and interpret the data that that are collected. In short, triathlon provides a unique space for the study of the use and interaction of wearable technology.

A New (Materialist) Perspective on Wearables

As the earlier example with Phil Gaimon indicates, and the work that follows will show, wearable technology devices exist and function as significantly more than analog objects to be handled and manipulated by those that own them. Rather, they are complex configurations that assert a powerful agency capable of altering the decisions that we make and the ways in which we construct our identities and ultimately how we see ourselves. Jane Bennett (2009) argues that objects have 'thing-power:' "the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle" (p. 6).

New Materialism allows us to view material objects as agentive things in and of themselves. Rather than viewing things as inert objects, we are able to understand them as active participants in active ecologies that shape our daily-lived experiences. Scholars have argued for increased awareness of the interplay between a device and its wearer in order to more fully grasp the exchange and its reciprocity (Davis, 2010; Pedersen, 2013; Rickert, 2013). Our engagement with our devices, the persistent, interaction through both our waking and sleeping hours, informs the manner in which we make sense of ourselves and our surroundings.

Sherry Turkle (2006) studies the impact of cell phones on the behaviors and sleep habits of teens, noting that we become, in essence, "yoked" to them, that they actually change our behaviors and sense of self. She argues that the customizable nature of the always on/always on us devices create a new state of the self itself. Citing Turner (1969), she argues "the self, now attached to its devices, occupies a liminal space between the physical real and its lives on the screen" (Turkle, p. 122). As these devices impact our understandings of ourselves, the nature of the interplay calls for a revised look at the subject/object relationship that researchers are prone to take for granted.

The wearing of our technology (and its wearing of us) enables performances of self in terms of gender and status (Jack, 2016). There are reciprocal interactions taking place with wearable technology. Perhaps not surprisingly, what we wear has a distinct impact on whom we believe ourselves to be. However, in the case of wearable technology, this is an arrangement constituted by multiple agentive parties. The study of our utilization and interaction with wearables provides opportunity to view and understand the nature of agency that these devices may possess (Kreitzberg et. al. 2016) and the manner in which this understanding impacts our interactions, whether they are dialectic or individually driven. Wearable technologies are sites of interaction whereby we collectively define and give meaning to context. These mutually constructed meanings are what Stacy Pigg calls embodied rhetorics. She understands that we interact with the outside world through our bodies and theorizes embodied rhetoric as referring both to "how the body acts during moments of rhetorical activity" and "how rhetorics, as systems that

structure meanings, are held, transmitted, and circulated through the movement and interaction of active bodies" (2011, p. 9). Wearable technology complicates and enriches this interaction by adding an additional component to the rhetorical structures we rely upon to structure meaning and make sense of our experiences. Haraway (1986) argues that technology has progressed to the point that it is entangled with human bodies and identity in such profound ways that it changes our conception of ourselves and of humanity. "Late twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines" (p. 152). Haraway's mythical cyborg collapses the ontological distinction between human and machine and anticipates the agentive power of wearable technologies yoked in networks with human athletes.

A Rhetorical Investigation of Wearable Technology

This dissertation investigates the use of wearable technology devices as active agents in sport. More specifically, it views the interactions that triathletes have with their wearable devices as rhetorical moments that impact decisions that are made and the ways that identities are formed. I argue that the results of these interactions are codetermined between human and nonhuman actors. This lens requires that we must first break with long held assumptions about subjectivity and objectivity set in place by the Kantian orthodoxy and carried on by various intellectual trajectories that sprang from that influence. "Social construction's ruthless criticism of

everything associated with nature produced a situation in which much ecological thought as well as anything associated with nature, such as nonhuman animals or plant life, were excluded" (Breau, p. 12). New materialism is a necessary lens in framing this alternate position. Rather than relying on a Cartesian model that privileged the subject/object binary, new materialism carves a space for nonhuman actors, emphasizing ontology over epistemology. Herndl and Graham (2013) argue that:

> A non-modern materialism provides a model of reality that escapes the twin errors of positivist objectivity and any correspondence theory of truth or reference on the one hand and the postmodern reactions of social construction and deconstruction on the other. What gathers these materialist orientations together is a whole-scale rejection of the Cartesian and Kantian legacy […] The two founding critical moves of this new materialism are a rejection of the modern distinction between subject and object and, second, rejecting epistemology and turning to ontology (pp. 3-4).

Further, a new materialist lens allows us to "focus on the nonhuman dimensions of ecology and to situate the cultural and the natural as interpenetrating and both part of a larger ecosystem or set of ecosystems in ecotherory and ecofeminism" (Breu, pp. 17-18). Decision-making is a complex process and, in the ecological world of wearables, interconnected among multiple actors, human and nonhuman. Understanding the roles these devices may play sheds light into the nature of the decision-making process in an increasingly connected existence and

opens up possibilities for technical communicators to more insightfully account for the roles that nonhuman actors play in these ecologies.

This dissertation argues that wearable technologies play a significant role in the process of decision-making of the athletes that use them. It seeks to understand that role and gain insight into the ways that the athletes themselves understand and interpret their use of the devices they choose. I argue that the body becomes a rhetorical space and that the decision making process is negotiated at the intersection of the athlete's current notion of their physical perceptoins and feedback from their wearable devices. As a result, the decision making process becomes a negotiated (and dynamic) construct that is subject to continuous revision through the interactions with wearable technologies.

There are two major questions that drive my study.

1. Why are age-group[4] triathletes adopting and using various wearable fitness tracking technologies?
2. How do wearable technologies modify the goals, purposes and behaviors of athletes?

Understanding the stated rationales that triathletes provide for their adoption and use of technology provides a starting point for engaging with the impacts of wearables on decision-making. Additionally, interpretation of their stories or descriptions of use and interaction might expand our understanding of the role and power of wearable technologies in human action.

[4] This is a term that is used to distinguish amateurs from professionals. Age group refers, literally, to participants of a certain age range. It is used to level the competitive field in a way that participants are ranked against others of a similar age range. All non-professional participants in triathlon are listed as age-group athletes and are ranked against other participants in the same age range.

Chapter Overviews

Chapter 1

This introductory chapter has laid the groundwork the chapters that follow. I have provided an illustrative example that makes the complicated and often obscured dynamics of our relationship with wearable technologies visible. I have tried to show that these devices are commonly taken for granted and perceived to exist as tools, rather than coauthors of decision-making. Phil Gaimon's quest to be King of the Mountain and his frustration at the limitations of his technology and devices, as well as his reliance upon them for direction and athletic execution make the point that we do rely on these technologies for understanding a context, and the decisions we make.

Additionally, I have made an argument for the use of New Materialism and ANT as appropriate lenses through which to view and better understand our engagements with wearable technologies. I agree with Christopher Breau, who argues, "New Materialism emphasizes the agency of matter both as it intertwines with but also exceeds human agency" (Breau, p. 18). I have shown that, in many cases, the wearable technologies that we can use in sport are able to do more than the athlete could on their own. To this end, I have introduced my two primary research questions: why do age-group triathletes adopt and engage with particular wearable technologies, and how do these technologies modify the goals, purposes, and behaviors of the athletes who wear them. I believe that following these two

questions will provide insight into untangling some of the complications of our interactions with wearables.

Chapter 2

The second chapter reviews the current literature in rhetoric, specifically work done in New Materialism, and makes arguments for distributed agency between human and non-human actors.. In this chapter I draw from Barad (2003), Frost (2016), Gauge and Jones (2016), Haraway (1986), Hayles (2008), Heidegger (1954), Latour (1999, 2005, 2012), Pedersen (2013), Pigg (2011), and Rickert (2013) to argue that the body becomes a rhetorical space and that the decision making process is negotiated at the intersection of the athlete's current notions of their physical condition and feedback from their wearable devices (both from the device itself and, potentially, from the recognition of that device by others). In this way, decision-making is a negotiated (and dynamic) process that is subject to continuous revision.

The rhetorical process that informs an athlete's conceptions of their current physical status and the decisions that must be made to either maintain or improve upon this is a collaborative one between the technology that they choose to implement and preexisting notions of their physical status. Here, in the interaction between user and device, lies a critical point of understanding that can potentially shift our understanding of the way that objectivity and subjectivity are created and exist with wearable technologies. I believe that the manner in which the athlete

both conceives of and utilizes various wearable technologies will be indicative of the ways that both are positioned.

Using Hayles' understanding of embeddedness and Drefyus' conception of skillful coping as backdrops, I argue that wearable technologies become a seamless, virtually unnoticeable part of the fabric for which they were designed, and of which the athlete herself is a part. In other words, purpose-driven devices become virtually invisible, both physically and cognitively, when they are fully absorbed into an activity.

Chapters 3

My third chapter details my methodology and methods, and introduces the results of my fieldwork. I have conducted a series of interviews with members of a local Clearwater triathlon team. Participants in the interviews were selected as a result of their participation in a survey that was made available to them prior to talking with me. The interviews served as an opportunity for the athletes to elaborate on their use (or lack of) of wearable technologies and their understandings of the devices.

Chapter 4

The fourth chapter presents the analysis and results of my research. In brief summary, my findings indicate that participants fall into two basic groups: athletes that identified as highly experienced in triathlon and those who self-reported as either novice or intermediate. While the overwhelming majority of all participants

expressed robust adoption rates of wearable technologies, more experienced athletes report more nuanced interaction experiences with their devices. For this group, adoption and use of wearables was more specific and intentional, the result of a greater understanding of the individual athlete's physical capabilities and limitations. Less experienced participants reported a broader use of the technologies, measuring somewhat less discriminately and interacting with them more often.

Context of use was important for both groups. Most respondents reported that their interactions with their devices was less during the swim portion of training and racing due to the physical limitations of not being able to consult the device as easily while in the water. Many participants report using wearable devices during their swim sessions but almost universally indicted that they did not interact with the data while training or competing. Rather, they consulted their data after the fact to reflect upon and to guide future training and racing sessions.

Generally, more experienced athletes reported a fairly seamless interaction with wearables, reporting that the devices function in much the same way as their other, analog equipment. There were, or course instances of frustration where devices malfunctioned, batteries died, etc. However, participants generally framed these as single use problems or instances of user error than they did as an ecological breakdown of some sort.

The second, less experienced group of athletes tended to see technology as interesting, but as something that they would "grow into" or learn about later. For them, the devices functioned less to relay actionable information than to indicate

when it was time to end an event or to provide comparative metrics against previous attempts.

In chapter four I present and analyze the results from my participant interviews. I begin by presenting my findings and then offer an explanation for them in terms of the theory of new materialism and material agency. As this project is not meant to be prescriptive in any way, the work here is intended to create a starting point for future work into user interaction with wearables. This project serves as a stepping-stone for work that investigates the physical or cognitive interactions with any new technology. Additionally, future work could be done that investigates the evolution of identity – how athletes move from one sense of understanding themselves to other, more advanced stages.

My survey and interview results position my participants as actants in three different ecological networks with wearable technologies:

1. Feel: human actants are responsible for decision making based on feedback they receive from their body. They do not use (or simply do not consult) a wearable device.
2. Translation: human actants rely upon the feedback from the device in order to make sense of their physical condition and to determine appropriate action. They cannot access (or do not trust) feedback from their body.
3. Cooperation: human actants rely upon a combination of feedback from their body and their device to determine physical condition and an appropriate course of action.

My survey results indicated that the more seasoned the athlete, the less crucial the device is in terms of understanding physical condition, but the more useful it may actually be in practice as it allowed them to more seamlessly shift from one network—Feel, Translation, Cooperation--to the next as changing contexts may require. I say this with the understanding that the latter group is likely to be more finely tuned into their sense of physical potential.

Chapter 5: Conclusions, reflections, and limitations

I conclude my study with chapter 5, where I briefly summarize my project and reflect upon the value of new materialism to rhetoric specifically and academic inquiry more broadly. Additionally, I explore some of the shortcomings of new materialist theory. I frame new materialism as a highly useful tool in a rhetorician's toolbox. However, I make no attempt to position it as a universally applicable.

Conclusion

There are two primary contributions this project makes to the field of rhetoric and composition. First, my project aims to shift dominant perspectives away from the subject/object model that has dominated rhetorical investigation and open them to a more holistic approach that sees disparate actors as a part of the same fabric. New materialism has begun this work by allowing nonhuman actants agency. My project explores the agency of things by placing these actants in dialogue with human actors and exploring some of the implications of these interactions.

The adoption rates of wearable technologies across all areas of use continue to rise as consumers and manufacturers alike find increasingly new ways to make them a part of our everyday lived experiences. While it is tempting to view these devices as ancillary add-ons to a push for increasingly active lifestyles or as innocuous tools that help us to be more informed and active in wellness choices, it is important to remember that, as much as we may frame our decision-making processes around notions of an individual consciousness, wearable technologies are a part of a much more complex ecosystem that involves human and nonhuman actants working in concert. As we move farther away from the prevailing notion of a subject/object relationship with our devices and begin to grant them agency, the potential of nonhuman participation in these relationships become clearer. While sports in general, and triathlon specifically, yields insight into the various ways that we engage with these devices, their dynamic nature and evolution require a consistent reevaluation of the contours of these relationships. Like the entanglement between humans and technology that led Haraway to write her cyborg myth in the 1980s, this increasingly dense entanglement of humans and wearable technologies changes the condition of our humanity and makes the reality of networked agency more apparent and powerful.

Chapter 2. New Materialism and a Theory of Distributed Agency

A Brief History and Framing of Wearable Technology

Though its most recent iterations may seem groundbreaking in many ways, the concept behind wearable technology is not a new phenomenon. The idea of placing devices on the body to enhance or facilitate an easier or more efficient engagement with the world can be traced back centuries to what now exist as taken-for-granted artifacts in our everyday lives. For better or worse, most would agree that the additions of these tools: eyeglasses, wristwatches, bathroom scales, etc. play significant roles in how we understand and live our lives. As far as contemporary iterations of wearable technology are concerned, Gouge and Jones (2016) define them as "those technologies, electronic or otherwise, whose primary functionality requires that they be connected to bodies" (p. 201). Beyond being just connected or attached to the body, recent technological developments have allowed modern wearable technologies to focus on and interact with the internal workings of the body, measuring heart rate, blood pressure, and sleep patterns, among other things. These, like their more primitive forebears, hold the promise of being productive, active participants in the manners in which we navigate and engage with the world around us.

While modern activity trackers are marketed as largely perceived as a recent phenomenon, the technology that drives them has existed in some capacity since the

mid 1970's[5]. However, it wasn't until Garmin released its Forerunner 305 GPS running watch in January 2006 that these devices began to make their way into the mainstream and see any semblance of significant adoption by the public. Even then, though the watch was a harbinger of things to come, the device only gained traction among a small number of distance runners. General public adoption was still many years in the future and, even in endurance sports circles, many eschewed the presence of digital technologies as violation or an invasion into an experience that was supposed to be pure, technology free. Though there were not the privacy concerns that we see today (the Internet of things did not exist) many in the endurance communities saw the technological presence as an unnecessary and unwelcome addition. One of my interview participants, Mark, who was a member of the initial running boom in the 1970's, explained his initial resistance to wearable technologies when they were first making their way to the public:

I remember when heart rate monitors first came out […] and I didn't see the point. Just didn't need it, you know? You know, they were advocating that if you will train by heart rate and stuff and I'm just thinking that why, you know, separate program, right? You'll do fine without it. So I was kind of resistant as a, as a runner.

Further impeding widespread adoption was the fact that wearing the device outside of athletic performances was problematic due to size and comfort constraints. The watch was significantly more brick shaped and awkward than the svelte, stylish versions commonly seen today. Adoption was select – a niche within

[5] Polar released the first wireless heart rate monitor in 1977

a niche. Even now, with wearable technology being generally accepted and nearly a ubiquitous sight, there are still some who reject their presence for myriad reasons.

Despite pockets of resistance among various segments of the public, wearable technology and personal fitness tracking devices are establishing themselves as a mature market that is reaching widespread adoption. "According to the International Data Corporation (IDC) Worldwide Quarterly Wearable Device Tracker, vendors shipped a total of 27.4 million units during the holiday quarter, besting 4Q14 levels by 126.9%. For the full year, vendors shipped a total of 78.1 million units, up a strong 171.6% over 2014."[6] Q1 of 2017 showed a 17.9% increase in the growth of wearables. The functionality that defines these devices (largely the ability to carry out various forms of bio hacking – heart-rate monitors, pedometers, GPS, etc.) is being embedded into more and more of the significant technologies and accessories in our worlds – phones, watches, jewelry, vehicles, etc. With the diversity in applications and the increased ease of ownership (as prices drop and competition in the technological spaces among manufacturers grows), increased scrutiny should be paid to both the devices and their potential uses. It is at this intersection of adoption and actual use that investigation of wearable technology offers a productive lens through which to better understand these technologies. In other words, it can be instructive to understand who is using the devices and how those devices are being used.

As wearables purport to tell us more about the way our bodies function, the implications of these understandings become increasingly important. The data that

[6] https://www.idc.com/tracker/showproductinfo.jsp?prod_id=962

wearables produce and relay to us have profound power and potential as they offer opportunities to steer the decision making of those who wear them. Attempting to understand the unique contours of the networks and the various actors that come together to help us make sense of these data is crucial if we are to move forward with these technologies in a safe, productive manner. Subjecting these processes to scrutiny opens the possibility that we may better understand how the devices function in real use situations and the impact that they have on us in our decision-making processes. The fact that the evolution of wearable, connected technologies and the continued growth and ubiquity of the internet of things offers no signs of slowing down makes this project that much more urgent.

Many of the questions that arise from the use and application of wearable technology are rhetorical in nature. Additionally, and perhaps, more importantly, rhetorical investigation may lead the way in anticipating questions that we don't yet know to ask. As the applications of wearable technologies are so vast, the concerns about their potential impacts is wide-ranging, covering issues ranging from health care and medicine (Albert 2015; Appleboom, 2014; Hoy 2016; Swann, 2009), to Identity and Self Quantification (Armfield, 2014; and McGrath, 2011; Choe, 2014; Kessler, 2016 Pedersen, 2014; Fox, 2017), to the implications of the big data that they record (Crawford and boyd, 2012; Crawford and Shultz, 2014). Outside of the implications surrounding the actual data that wearable technologies collect, the physical implications of wearables also warrants attention.

Scholars have investigated the impact that the physical experience of a device has on the way that we experience and understand ourselves. Gouge and Jones

(2016) state that wearable technologies create “new rhetorical situations and arguments […] new possibilities for memory created by mobile data, and new ways of understanding how a wide variety of wearable technologies create and influence conditions for communication and persuasion” (p. 199). They argue that this process of (re)framing the world through wearable technologies allows for new ways of looking at the evolution and practice of rhetoric and enables us to “consider how these devices impact opportunities for embodied communication, the performance of our digital selves.” (p. 205). Kessler (2016) claims that wearable technologies can function as agentive instruments in the creation of identities, rather than merely as tools that measure or quantify an external one. She claims that “a more engaged and thorough rhetoric of wearability has the potential to not only expand our categorizations of what it means for a technology to be "wearable," but also to offer a more nuanced understanding of wearable technologies' relationship to embodiment" (pp. 247-8).

Kessler’s use of the term embodiment is crucial in that it makes space for discussions that allow for the agency of the wearable itself. Mendleson (1998) states that the rhetoric of embodiment is “the effort to bring form and content into union and thereby to provide rhetorical theory with a firm, even material base” (p. 38). Crucially, this union is agnostic, and does not privilege human actors over nonhuman ones. Embodiment is a concept that I will pick up later in attempting to shift the focus of rhetorical inquiry away from the Cartesian model defined by a dominant subject and to refocus on the impact of the interactions, or what Latour calls the “socialization” of all actants in a network.

Contemporary wearable technologies enact multiple processes in addition to their intended functions of monitoring the body in some way. Jack (2016) reminds us that as much as a device may serve to create or reveal an identity or current status, it also has the power to conceal. She argues that the use of wearable technologies "promise visibility and invisibility.' On the one hand, they are meant to fit seamlessly into our lives, so that we forget we are wearing them; they become a part of us. At the same time, they are never completely invisible, but advertise themselves as status symbols" (p. 217). This process of simultaneously exposing and concealing creates a highly rhetorical dance as our understandings of ourselves and our bodies are constantly in flux and heavily dependent upon context. Jack's use of the word "status" is particularly insightful here, though, as she clearly understands any identity or conclusion as a temporary one. The application of wearable technologies does not indicate or bestow a permanent status. Rather, for as long as they are in use, wearables reveal (and conceal) dynamic, contextual states of being. In her study, the breast pump may create a positive status, "mother" and "productive employee" in the same space as easily as it could frame a negative one as a financial liability due to her need to be "mother" in a working space and thus potentially limiting productivity. The revealing and concealing that wearables enable is not a stable, singular rhetorical move. Rather, it is one that is temporary, jointly created and enacted between the device and the person wearing it.

Understanding the perpetually shifting nature of our states of being allows us to frame the conversation of wearable technology as dynamic, informed by multiple internal and external factors. As a result, we are able (required) to frame wearables

as active participants in these rhetorical moments rather than to see them simply as tools taken up and manipulated by human agents.

The shift in perspective from viewing wearable technologies as passive tools and, rather, positioning them as active agents challenges traditional understandings of rhetoric that have historically accepted a subject/object relationship as the de facto organizational principle. This move allows for a reconfiguration of the manner in which rhetoric functions and the insight that we might gain into our interactive with the material things around us.

To provide an effective roadmap of my argument about the rhetorical nature of our interactions with wearable fitness technology I must first outline the steps that I will take in this chapter to make it clear. Additionally, it is helpful to better understand the organizational principles that have guided my thought. In order to effectively review the relevant literature it is necessary to:

1. Provide a background that clearly identifies the current research in rhetoric and composition as it relates to the intersection of wearable technology and rhetoric;
2. Examine the widely accepted subject/object paradigm that undermines current scholarship in rhetoric and composition;
3. Identify the objections to the subject/object relationship that have been made and examine the manner in which they apply to this project;
4. Make my theoretical lens, new materialism, clear and address the deficiencies of the subject/object relationship and examine where and how rhetoric moves forward.

The Shift from Subject to Object Orientations: Reframing Wearable Technologies

As I have discussed, much of the literature on wearable technology has been interdisciplinary in nature and has focused on three main areas: medical applications/privacy concerns, identity construction/self-quantification, and the gathering and manipulating of big data. While these areas of interest certainly overlap in places and have resonance within rhetoric and composition, the field has not, until recently, given the topic much attention, especially in regard to the ways that the devices may be acting upon us, granting them any measure of autonomy or agency. While there has been an uptick in the interest in wearable technologies, the focus has predominantly been in two places: on the materiality of the devices and the manner in which they are used (Pedersen, 2013; Kessler, 2016; Melincon, 2017) or as cautionary tales for their inability to guarantee acceptable levels of privacy (Baruh, 2007; Chasmar, 2016; Crawford and Shultz, 2014; Teston, 2016). In both cases, the literature tends to frame them as tools, reinforcing the Cartesian model. In her book, Foucault's Fitbit: Governance and Gamification (2018), Jennifer Whitson argues that wearable devices are "tools of self-governance" (p. 340), framing the devices (for her, a Fitbit) as mechanisms that are used, ultimately, to control our behavioral choices. This perspective, identifying the Fitbit as a tool does two things: First, it drastically limits our ability to fully appreciate and engage with the manner in which they function in practice by denying them agency. And, secondly, it skews potential understandings of the value and impact inherent in the device by predisposing us to see it as either good or bad, merely aiding in the

pursuit of goals. Neither of these perspectives is fully productive because they perpetuate incomplete inquiries that deny agency to the devices.

Much of what this rhetoric can offer the discussion of wearables is limited because of the a priori acceptance of a Modernist perspective that privileges subject/object relationships between nonhuman and human actors as linear and hierarchical. The focus has primarily been placed on the materiality of the devices and the manner in which they are used rather than attending to the ways in which these devices are able to assert themselves, complicating rhetorical situations and thus deepening our engagements and enriching our understandings.

Latour (2001) offers us a way out of the restrictive modernist binary that defines/limits rhetorical actors in terms of subjectivity and objectivity. In Pandora's Hope, he argues that, rather than categorizing things in terms of subject/object, we move to what he calls collectives, which he defines as "an exchange of human and nonhuman properties inside a corporate body" (p. 193). In framing relevant actors as equally agentive parts of a system, Latour removes the limiting binary relations of subjectivity and objectivity. It is important to note, though, that Latour's project is not to grant subjectivity or deny objectivity. Rather, his aim is to "avoid using the subject-object distinction at all to talk about the folding of humans and nonhumans […] to capture the moves by which any given collective extends its social fabric to other entities." (p. 194, emphasis added). His is not a project of establishing or redefining hierarchy. Rather it is a move to more broadly conceive of the possibilities of the rhetorical situation beyond two established actor positions. By viewing actor interactions in terms of the collective, Latour exposes how "a

collective of one given definition can modify its makeup by articulating different associations" (p. 194). Dissolving the subject-object relationship allows for a dynamism to emerge that broadens and deepens rhetorical investigation and extends its scope. Rather than being framed as static entities with a singular purpose (or set of predefined purposes), the collective takes on dynamic potential that can be fruitfully explored in ways that the traditional binary foreclosed upon.

Object-oriented rhetoric fundamentally alters the way we look at the connections among human and nonhuman actors. This rhetoric disconnects the object from its connection to the subject, and shifts the ontological and epistemological paradigms from a vertical orientation to a horizontal orientation. In this new incarnation, the divorced subject and object no longer creates hierarchically determined agency. Instead agency becomes the result of organization within a network of actors. However, simply freeing the object from its connection to the subject does not, in and of itself, eliminate the notion of object and subject entirely. These two terms are part of a necessary grammar, an ordering, and merely doing away with them would do little to impact the manner in which we look at relations. Rather than simply doing away with notions of subjectivity and objectivity, it is necessary to understand the manner in which participants in a rhetorical situation come together and act that we might better understand the implications of any given combination of actors and actions. A shift from modernist thinking, ineluctably attached to the Cartesian "I think, therefore I am" philosophical position that stations rational man at the center of all action is necessary to more fully understand the potentiality of these situations.

There are several historical/philosophical moments that attempt to alter/broaden the way that we understand our interactions with the world by shifting away from the subject/object binary. Every philosophical "turn" marks such an attempt. However, rather than trying to account for every such moment, I have chosen to focus on Martin Heidegger's 1954 "The Question Concerning Technology" as an inflection point. It is clear that he is uncomfortable with the traditional implications imposed by modernist though and has distanced himself from them by adopting a phenomenological perspective rather than privileging subject/object relationships. For Heidegger, the notion that man (subject) could possibly control technology (object) was anathema to his understanding of the ways that technology worked on us.

Heidegger's mistrust of modern technology serves as a useful heuristic in this instance as, rather than getting mired in the subject/object model, he granted technology agentive affects. For him, (an understandable) cynicism and distrust of technologies deeply informed his perspectives on our interactions with technology. However, the manner in which Heidegger understands how man engages with technology no longer needs to be held as the de facto starting points for our engagements with modern technologies. For Heidegger, technologies shaped man's views and positioned us in ways that were oppositional to nature and, ultimately, dangerous.

Heidegger sees modern technologies as instruments that ultimately enframe, or shape the perspective that their users are able to have of the world and sets us on the path of conquest. "Modern technology as an ordering revealing is, then, no

merely human doing. Therefore, we must take that challenging that sets upon man to order the real as standing-reserve in accordance with the way in which it shows itself" (p. 9). In other words, he argues that our technologies define the manner in which we see the world around us. Implied in his assertion is that this forced perspective carries with it an urging for human dominance over that world – the standing reserve, or the domination of man over nature that transforms nature into an energy stockpile. "So long as we represent technology as an instrument, we remain held fast in the will to master it" (p. 17). His framing of technology is such that it is far from an inert, objective presence that only gains its meaning in relation to a larger subject. We see here, clearly, that technology pushes back. Dreyfus (2014) argues, "Heidegger's significance […] lies in his recognition of a kind of intentionality that does not involve intentional content at all. He wants to show that neither practical activity nor contemplative knowing can be understood as a relation between a self-sufficient subject with its intentional content and an independent object" (p. 15). This positioning of the relationship between man and technology that lies outside of human centered intentionality paves important steps toward an understanding of our engagements with technology that, rather than being saddled with Heidegger's paranoia over the perspectives that it necessitates and the resultant damages it inflicts, allows us to approach our engagements with technology as agnostically benign.

In Heidegger's eyes, man's relationship to technology challenges modernist assumptions about a subject/object relationship between humans and the world; for Heidegger, tools are agentive in that they shape perception and, as a result,

action. In principle, this is not entirely dissimilar from the manner in which Latour understands black boxes that, for him, are the result of stably functioning collectives. Maggini (2014) states that

> Both Heidegger […] and Latour share a distaste for what is the quintessence of modernity, that is the subject-object dichotomy. This distaste lies at the heart of Heidegger's account of Zuhandenheit. For Latour, the black box replaces traditional substance (p. 104)

Neither Heidegger nor Latour understands the world as existing at the foot of an all-powerful human master who is able to unilaterally enforce his will over nature. Rather, they understand agency in terms of interactions. For Heidegger this was (presence-at)/(ready-to)-hand; Latour sees these instances similarly as collectives (which, by definition, are nondurable, shifting, assemblages of actants) functioning well or dissolving and reforming as a different grouping of actants.

Harmon (2009) compares Heidegger and Latour in this way:

> Like Heidegger's tools, a black box allows us to forget the massive network of alliances of which it is composed, as long as it functions smoothly. Actants are born amidst strife and controversy, yet they eventually congeal into a stable configuration. But simply reawaken the controversy, reopen the black box, and you will see once more that the actant has no sleek unified essence. Call it legion, for it is many (p. 34)

In looking at Heidegger's apprehensions regarding technology through a contemporary lens, Bailey (2014) arrives at a troubling conclusion regarding our most modern technologies – those that actively monitor our very selves, cautioning

that “when even our own selves, facts about our cognitive orientation, our emotions (notably empathy), etc., are technologically manipulated, our deepest selves will give way to enframing; we will order ourselves and take an inauthentic relation to our identity.” (p. 49)

One of Heidegger's claims in Question Concerning Technology is that the “revealing that holds sway throughout modern technology… [is]… a challenging… which puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such” (p. 320). Applied to the use of contemporary wearable technologies such as those used in triathlon, Heidegger’s argument is, essentially, that we, ourselves, become a part of the standing reserve! While this argument is problematized by the fact that Heidegger’s modern technologies enframed the manner in which we see nature, the same rules can apply: It could well be argued that modern wearable technologies enframe the human body, revealing an essence that, in this case is a quantified athletic potential. Heidegger says:

> The subject-object relation thus reaches, for the first time, its pure "relational," i.e., ordering, character in which both the subject and the object are sucked up as standing reserves. That does not mean that the subject-object relation vanishes, but rather the opposite: it now attains to its most extreme dominance (p. 173)

Heidegger does not attempt to do away with the subject/object relationship. Rather, he sees both as equally enframed by technology. Through this lens, we, substituting for nature, become subjugated, trapped, stored, quantified. We become

the victim of our technologies, limited by a too-high heart rate, or a too-slow mile split.

So, while Heidegger was skeptical of the power of technology and the manner in which he saw it as instrumental in shaping world views, he imagined a scenario where we, ourselves, like nature, become enframed by technology and end up comprising the standing reserve. In this way, our engagements with technology create the potential for us to lose ourselves to the very machines that we rely upon to understand ourselves, ultimately costing us our humanity. What Heidegger could not see, however, was the possibility of a shared agency involving human and nonhuman networks that, rather than enframing and limiting us, opened new potentialities. While it would be crass to dismiss Baily's concerns out of hand as, through the Heideggerian lens they may well hold, it is important to acknowledge that contemporary modern technologies offer many positive affordances to offset Heidegger's techno-paranoia.

Heidegger, Foucault: Scary Tools

Heidegger and Foucault both arrive at their understanding of technology through the Greek word techne. For Heidegger techne is similar to poiesis, the bringing forth or revealing through which we uncover the essence of technology. However, ultimately, it ends with bestand and enframing. Foucault understands techne as a "practical rationality governed by a conscious aim" (O'Farrell, p. 158). It functions as a direct result of intent. Though they arrive at different conclusions regarding the roles that technology plays, both are highly wary of the manner in

which they function and the impacts that they have in shaping our perceptions of the world and our place in it.

In Question Concerning Technology, Heidegger makes his distrust of modern technology very clear. He argues that the essence of technology is that it reveals aletheia, truth. Modern technology, however, functions differently – it, like traditional technology, reveals something[7]. However, rather than revealing truth, modern technology, for Heidegger, reveals a challenging. "The revealing that rules in modern technology is a challenging, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such" (p. 6). This demand led Heidegger to two key conclusions about modern technology. First, bestand – the standing reserve – the demand placed by modern technology that defines how we see resources. And, secondly, gestell – enframing. "Enframing means the gathering together of that setting-upon which sets upon man, i.e. challenges him forth, to reveal the real, in the mode or ordering, as standing-reserve" (p. 10)

Heidegger understood that when we enframe we unconceal the standing reserve—we lose sight of the things that don't fit in the standing reserve into concealment. We look at how nature fits with us rather than seeing how we should fit with nature. In other words, modern technology directs and shapes our vision in such a way that we can only see what technology wants us to see. This is further problematic in that, as technology shapes our understanding in one way, it

[7] Heidegger doesn't make a clear distinction between technology and modern technology. However, the implied distinction seems to lie in the way that the two act – technology ends with poiesis, and aletheia. Modern technology enframes and requires the standing reserve.

simultaneously conceals those things for which it has no use. In essence, we become submissive to modern technology as it shapes and constricts what we can see and, therefore, what we can do. And we too become a standing reserve.

Foucault, like Heidegger, had similar fears and concerns about the roles that technology (ultimately, discipline) played in shaping our decision-making and the levels of control that could be placed upon us. In the shift from public to personalized punishment, Foucault saw state control being exerted through the infrastructure that enabled the individuated sorting and, then, punishment. Perhaps his most famous example is Bentham's Panopticon – a tower erected in the center of a circular prison yard with darkened windows that allowed guards to see in to the cells but prevented prisoners from seeing into the tower. This structure, Foucault claimed, created the impression that the prisoners were under continual surveillance. Though they could not be sure that they were being watched, the darkened windows of the tower and their placement in a manner that allowed for complete vision into the cell created a situation where prisoners had to assume that they were under constant surveillance. Regardless of the reality, prisoners had to behave as if they were being watched and, as a result, were forced to behave themselves under threat of punishment. In this manner, the prisoner assumes the subject role and, as a result, is controlled through their visibility, regardless. For Foucault, the primary purpose of state technologies was to surveil. "Surveillance is permanent in its effects, even if it is discontinuous in its action." (p. 201)

Ultimately, the concern that both Heidegger and Foucault shared regarding modern technologies was that they are not simply tools that we use (control) to

make a task easier, or more efficient. Rather, modern technologies, scientific or infrastructural, masqueraded as such while exerting considerable levels of control. "Disciplinary power, on the other hand, is exercised through its invisibility; at the same time it imposes on those whom it subjects a principle of compulsory visibility" (p. 187). Even more problematic than the controlling nature of technologies for Heidegger and Foucault, was the fact that the controlling impulses were hidden, unseen by those who, as a result, acquiesced unknowingly. Whitson (2013) argues that gamification creates this same invisible governance. "What is important about digital games is that the rules are not only formalized, they are completely hidden from players by the black box of the game software" (p. 4). Applying this notion to the gamification of fitness trackers, she continues, "enabled by increased levels of surveillance (self-monitoring and otherwise), these projects use incentivization and pleasure rather than risk and fear to shape desired behaviors" (p. 5)." Wearable technologies are presented to us as tools that enable us to do amazing things, with slogans such as "Beat Yesterday" (Garmin), "Just Do It" (Nike), "Meet Your Better Self" (Suunto), to name a few. The impact that they exert upon users is hard to deny.

Richard Dreyfus (1989) reads Heidegger's later understanding of technology's effect on us less bleakly. Rather than becoming a part of the standing reserve, Dreyfus claims that Heidegger's technology benefits us. Rather than necessarily transforming everything into the standing reserve, technology can benefit us, making us better. He says:

> In the end, however, he seems clearly to hold that technology can treat people and things as resources to be enhanced without setting meaning-

> giving subjects over against objectified things. A year after the previous remark about subjects and objects reaching extreme dominance Heidegger appears to retract his view about objects at least, in his observation that nature has become "a system of information" and a modern airliner is not an object at all, but just a flexible and efficient cog in the transportation system (p. 85)

Donna Haraway's landmark essay, A Cyborg Manifesto marks another profound shift away from modernist binary thinking. She posits a fictional character, the cyborg, a feminist amalgam of human and machine, that disrupts the dominant male political hegemony and opens spaces for subjugated groups by making new connections and practice possible. However, unlike Heidegger, Haraway sees causes for optimism as we engage with modern technologies. She argues that viewing modern technological engagements through a single lens is to miss a crucial point, that in addition to potentially losing certain things that we privilege, we might also lose our dependence on these things. In other words, we might move from being enframed by technology to being symbiotically enmeshed with technology, granting agency back to us. In bringing the two together into a unified presence, the cyborg undermines the distinction between human and machine. This move disrupts the single locus of agency and complicates static notions of being and agency, a move that anticipates both Latour and new materialism, providing an early model of networked agency.

In her "ironic political myth," the cyborg resists traditional loci of power, disrupting hegemonic practice and instituting new modes of communication and

interactions. In the deconstruction of traditional sources of power and governance, praxis is inexorably changed. Haraway (1991) argues that out of this change come new collectives. Her cyborg imagery "suggests a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves. This is a dream not of a common language, but of a "powerful infidel heteroglossia" (p. 28)

It is here that new materialism and object-oriented rhetoric become particularly helpful in advancing us from a Heideggerian philosophy that feared modern technology, through a cyborg myth that revolutionized our interactions with technology, ourselves, and each other by providing a language with which we may engage with the myriad shifting collectives that our engagements with the everyday nonhuman actors present.

Jane Bennett (2010) argues that the end of the 20th century brought a change in perspective that did away with "organicist" models and paved the way for what she calls "assemblages," which are "not governed by any central head: no one materiality or type of material has sufficient competence to determine consistently the trajectory or impact of the group. The effects generate by an assemblage are, rather, emergent properties, emergent in that their ability to make something happen" (p. 24). The agency, or ability to act, displayed in Bennett's assemblages is not the sole domain of human actors. Rather, we see agency as the product of the interaction between multiple human and nonhuman actors.

Bennett explicates this interplay among actants and the resultant output, agency, in her recounting of the 2003 power grid blackout throughout the Northeastern United States, the result of a complicated malfunctioning interplay of

human and nonhuman actors that ultimately left 50 million people without power. When viewed through a new materialist lens, this scenario clearly challenges the traditional Cartesian model that posits human subjects and material objects and prizes the notion of human intentionality. Rather than human agents being the sole determinants of the process, sequence, and outcome of events, new materialism posits that multiple actants actively participate in the assemblage, combining to yield an unforeseen event, what Latour calls a "slight surprise of action." Bennett further channels Latour, referring to "an effectivity proper to the action itself, arising only in the doing and thus in principle independent of any aim, tendency, or characteristic of the actants" (p. 27). The outcome of such interactions or socializations, as Latour (2005) calls them, is not something that we can anticipate. "Action should remain a surprise, a mediation, an event" (p. 45). Devoid of subjectivity and objectivity, all actants play a role in determining an outcome. And, since none of them are solely in the driver's seat, any outcome is somewhat unpredictable.

Bennett equips us with language to discuss the interplay of human and nonhuman actors and their relationships. Additionally, she provides us with a solid foundation from which to begin a conversation of Actor-Network-Theory (ANT), which will then allow us to trace those relationships to better understand the implications that they have on agency. From here, we are then able to engage in a discussion focusing on the use of wearable technologies with the language and perspective necessary to productively parse them for meaning.

Reorganizing the Toolbox: A Case for New Materialism

The shift away from binary Cartesian thinking to more complex models of interaction begins with Haraway's Cyborg and continues on to Bennett's assemblages and a new materialist lens. These moves are natural ones that account for both our increased dependence upon our devices as well as their increased ability to clearly act – both independently and in our stead. With each shift away from human intentionality as the sole determinant of action, the autonomy of the human subject is lessened and human subjectivity is increasingly pushed off-center. These shifts away from single (human) subjects to models that allow for distributed agency make room for an increasing number of new actors with increased ability to act. Additionally, each move brings us more in line new materialist thinking, which provides a productive lens for looking at the unique ways that wearable technology informs our understandings of the world and our actions within it.

The new materialist focus centers on issues of materiality, embodiment and subjectivity as they relate to the manners in which we make sense of the interactions between human and nonhuman actors. Many theorists at the forefront of new materialism (Latour, 1991, 1999, 2005; Coole and Frost, 2010; Hayles, 1999; Bennett, 2010) have made the case that we need to move beyond the dominant Cartesian models that privilege subjectivity as the de facto starting point of investigation and look beyond consciousness or the soul as determining factors for agency. The emergence of smart, connected technologies and the increased sophistication of AI make this adaption of a new materialist lens productive in addressing and engaging our current, modern interactions with the world. This is

especially the case in places where technological instruments may not be immediately noticeable or exist as taken for granted as it is in these places where we are most vulnerable to their influence.

Traditional models that understand relationships among human and nonhuman actors as hierarchical limit our ability to fully appreciate the dynamic relationships that we have with our things. They prize human intentionality and, in doing so, fail to take into account the effect that nonhuman actors have on these relationships. Coole and Frost (2010) argue that prevailing methods of analysis and observation are no longer suitable for examining and exploring the current state of materiality and our interactions with material objects. They claim, "new materialist ontologies demand a rethinking of, and renewed attention to, the dynamics of materialization" (p. 37). Attention to the materiality of nonhuman actors and the manner in which they exist requires that we adjust our understanding of our relationships with them. Rather than positioning them as subject to human intentionality, as has traditionally been the case, new materialism creates a horizontal ordering schematic that allows us to better understand the reciprocal relationships without privileging one actor or position over another. This, in turn, enables us to view wearable fitness devices as active participants in the formation or maintenance of a given coauthored reality. Attending to the ways that these realities are constructed and acted upon is critical for a deeper understanding of the impact of these devices and the promise or concerns that they hold.

Many of the discussions and concerns that surround wearable technology spring from the limitations inherent in the subject/object ordering. When we

disallow agency to nonhuman actors, we limit the benefits of our things to a function list. We rob the act of socialization (as Latour understands it) of the element of surprise – there can be no added benefit that is not previously intended or anticipated.

Rather than accepting the simple subject/object binary as our necessary starting point, Hayles (2009) argues that modern culture has problematized views of the human subject. She claims that, rather than being wholly independent, we are parts of larger, complicated systems that do not act autonomously. We are a part of a larger environment and, as such, we are impacted (and constrained) by the actors and actions within that environment. She states, "No longer is human will seen as the source from which emanates the mastery necessary to dominate and control the environment" (p. 290). New materialism frames our relationships with our surroundings in such way that, rather than asserting total control over our environments, human actors are now also subject to the agency of nonhuman actors and must exist in concert with them rather than dominion over them. Pradhan and Singh (2018) argue that privileging human subjectivity reveals only a partial, incomplete reality and that we must make space for nonhuman actors when considering the ways in which we operate in the world. "What is quite urgent now is a radical reappraisal of the notion of the matter, reading human as only a part (not whole) in this materialist scheme of things — a move from the materiality of human centered subject/ivity to a new transformative space of posthuman subject/ivity" (p. 91). As we exhibit an influence over our devices, so too, do they impact and

influence us. It is a mistake to view things as hierarchically, with nonhuman actors, existing passively, simply to be utilized.

Our understandings of the world, of our place and abilities in it, are dynamic and inextricably tied to nonhuman actors rather than being the providence of human intentionality. Bennett (2010) argues, like Hayles (2009), that the world is connected and in a continual state of evolution. However, unlike Hayles, Bennett very much wants to dissolve the subject/object binary that has dominated contemporary thought. She sees the agency of non-human actors as powerful, enabling. And, in a world where what are traditionally considered objects exert subjectivity, everything is a subject. Or, perhaps, drawing from Latour from earlier, we should shift our attention and focus away the terms subject and object entirely. According to this view, a wearable device and its wearer mutually author a reality; no one actor acts alone. Bennett calls this "distributive agency" which "does not posit a subject as the root cause of an effect" (p. 31). She claims that no act is self-generative; nothing acts alone. "Any action is always a trans-action, and any act is really but an initiative that gives birth to a cascade of legitimate and bastard progeny" (p. 101). In this model all active elements of a rhetorical situation become agents. Their positions exist independent of a grammatical context, yet their actions mutually inform an outcome.

Given the agency of nonhuman actors and the countless points of engagement that we have with them, the idea of a static, enduring context is untenable. Rather, as Bennett (2010) argues, we exist in a swarm where our task in understanding context is to identify the contours of the swarm and the nature of the

relations among its parts. As nonhuman actors continue to proliferate in our lives, the density of the swarm increases, as does its complexity. Additionally, as new materialism grants agency to non-human actors, the concept of objectivity fades into a world dominated by active actors. Bennett discusses Darwin's example of the manner in which worms exist alongside human and other, nonhuman actors, form an assemblage that is lacking a single agentive subject but, yet, still arrive at "intelligent improvisations." She argues that "this assemblage is an interconnected series of parts, but it is not a fixed order of parts, for the order is always being reworked in accordance with a certain 'freedom of choice' exercised by its actants" (p. 97). Understanding the interconnectedness of the parts and accepting a fluid ordering is key in appreciating the role that human and nonhuman agents play in responding to each other in the ecologies that they form when they act in concert with each other. In this way, new materialism allows us to frame our interactions with wearable technologies as dynamic things, contextually bound but constantly in flux.

Looking into the Fishbowl: Ecologies of Wearables

Decentering the human subject and making room for nonhuman actors to exist along a horizontal rather than vertical axis of relation to humans enables us to position them in an active ecological relationship. In this model, both human and nonhuman actors actively participate in any action and are both responsible for all outcomes. It is important to note, though, that in a model where outcomes are no

longer the result of human intentionality alone, the concept of a glitch becomes relevant and requires some explication.

The concept of the glitch is fascinating because glitches are impactful while being both irrational and, seemingly, random. I refer to a glitch as a moment when actual outcomes or actions don't materialize as we expect them to as the result of unanticipated nonhuman actions. The term implies an unforeseen occurrence as the product of socialization among connections in a network. From a human perspective, this looks like something going wrong. Given the interconnectedness of all things, when something goes wrong on one end of the model, its effects are felt throughout the model in ways and places that can be hard to predict (Johnson and Johnson, 2016). As problematic or traumatic as it may seem, on the surface, the real function of a glitch is to reveal the connections in a network of actors that otherwise go unnoticed or taken for granted. It is the moment that causes us to become aware of and open what Latour (1999) calls black boxes – the associations of nonhuman actors that go unnoticed until they function in unforeseen ways. Latour says

> The way that scientific and technical work is made invisible is by its own success. When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become (p. 304)

The black box is a useful concept in that it provides an opportunity and invites us to view all nodes as active and productive and encourages us to attend to

them. With the model of ecologies as a backdrop, it's easy to frame any given wearable as a part of a larger system that, through a new materialist lens, is a complicated, dynamic, and agentive "thing" that must be viewed contextually and from multiple perspectives.

Viewing the world of wearable fitness technology ecologically is helpful to understand the interrelated roles that all actors play; to use Latour's term, it helps to make the socializations within the network clear. While it is tempting to distill the relations in a network to notions of (user/subject/human) and (object/device), doing so paints a wholly inadequate picture and produces a fractured understanding of the manners in which these ecologies form, function, and evolve. Rickert (2013) offers us a new definition of rhetoric that is helpful in a world that is no longer clearly demarcated by the familiar binary terms of sender and receiver and speaker and audience. He proposes that we consider rhetoric as

> A responsive way of revealing the world for others, responding to and put forth through affective, symbolic, and material means, so as to (at least potentially) reattune or otherwise transform how others inhabit the world to an extent that calls for some action (which can include, of course, steadfastness, refusal, or even apathy). (p. 162)

Rhetoric is enacted by the nature of things in relation to other things. It is affective, shaped by what things do when they are called into action. It is symbolic, informed by what things mean in a given context. And, it is material, informed by the presence of things in a space– their physicality. In other words, Rickert argues that we come to understand the world around us by the presence and interaction of

things in the world with each other. Rather than understanding anything by its static presence, rhetoric functions through the dynamic nature of things in perpetually shifting contexts to reveal what they are.

As helpful as Rickert's emphasis on associations is for the positioning of wearable fitness devices as rhetorical agents, his understanding of Kairos is equally important. Several scholars (Gouge and Jones, 2016; Jack, 2016; Pigg 2010) have argued that the materiality of wearable technology, their physical presence can be as impactful as their functionality. For Rickert, the notion of Kairos is relational. We come to see and understand the world, not just by an object's materiality, but, also, by where things are in it and the manner in which they act upon us. Along these lines, subjectivity and objectivity are meaningless concepts as nothing can be privileged above one or another. We are all mutually impactful and relevant. What we want, or intentionality, is no longer the driving force in determining an outcome. However, where things are in relation to each other is highly relevant. In the model that Rickert proposes, it's no longer about hierarchy. It's about the relationships.

Wearable fitness technologies exist as a part of a broader ecology that exists among the internet of things and incorporates such disparate actors as the devices themselves, cellular phones, internet routers, etc. (Swan, 2009). These elements, when working in concert, provide a whole, unified, expected experience. However, when a part of the world "breaks," unexpected things happen and our interactions and understandings are altered. In this way, the ecology evolves and new moments of stability come into being.

Wearable technologies are dynamic and can evolve well after their release. Additionally, the manner in which they are ultimately utilized is contextual to the user. To fully understand the potential of their applications we need to look beyond their intended or original assumptive uses and allow that they may function productively in ways that are unforeseen or unintended. To further explicate the connections between wearable technologies and rhetoric we can turn to Thomas Rickert's reading of Plato's Timaeus. In the Timaeus, Plato introduces the chora, a place of becoming and being. Rickert (2013) reimagines the chora in terms of ambience, which is helpful in moving beyond human centered subjectivity and intentionality as the sole drivers of agency. Crawford and Ballif (2014) state, "[Rickert] retheorizes rhetoric as ambient—as persuasive, but as a persuasive process, context, or relation that is not reducible to a subject, to epistemology, to the human" (p. 1, emphasis added). Rickert understands ambience, rhetoric, as a reciprocal process between multiple actors, none of whom can rightly lay claim to subjectivity.

> What ambience allows us is a way of seeing not only our selves inhabiting spaces, but spaces inhabiting us. This suggests a "fresh foray" into the chora, a third place, which is the "ancient attempt to think the relation between matter and activity, work and space, background and meaning" (p. 42)

Taken together, new materialism's decentering of the subject and the centrality of context and interaction creates the ambience that Rickert privileges. The study of our interactions with wearable technology becomes one that must focus on the manner in which these devices are actually used and made anew with

each use. We understand that all meaning is made and understood as a result of its place in contextual interactions,

Wrapping Up

Our engagements with wearable technologies are contextual ones informed by multiple, shifting nonhuman actors. In this chapter I have proposed the use of new materialism as both a means of escaping the limitations of the subject/object relationship and as an appropriate lens for rhetorical investigation of our interactions with wearable technologies. This shift allows us to avoid the trap of seeing wearable technologies as passive tools that function only in response to human intentionality. Rather, I propose that our engagements with these technologies are coauthored; that wearable technologies exert agency and have a profound impact on both our understandings of ourselves and the decision-making processes that we work through as we work with data.

In the chapters that follow I describe my methodology for investigating the manner in which amateur triathletes engage with a variety of wearable technologies. I will then discuss what information is collected by the devices, how the information is displayed by the devices, processed by the triathlete and, ultimately, the results of these interactions. Finally, I will examine the ways in which decisions are made, based upon the understandings that are developed with the technology and the manner in which these decisions impact action.

Chapter 3. Methodological Approach, Data Collection and Research Tools

Initial Steps

As wearable technologies are increasingly knit into our daily lives, the necessity of understanding their potential influence on our thinking and decision-making is increasingly important. The purpose of this study was to understand the rhetorical significance of the interactions between human and nonhuman actors investigating how wearable devices impact the manner in which amateur athletes train and race in triathlon. A questionnaire was developed to gain an initial understanding of participant engagement with wearable technologies. This instrument was then distributed to a local triathlon team in Clearwater, Florida. In total, I received 61 responses to the questionnaire. Upon its completion, participants who had taken the survey and indicated that they would be willing to participate in an in-person interview were identified. I conducted 14 in-depth interviews with participants to obtain a more nuanced understanding of the engagement between the triathlete and their technology. After these initial 14 interviews were completed, they were transcribed and coded. Then, I conducted a final round of follow-up interviews with four of my participants for the purpose of member checking. The aim of this last round was to confirm my understanding of the information that my participants had provided me as well as to possibly gain additional insight into their use habits.

Methods

Two data collection tools were used in this project. First, I created a survey that was posted to a private webpage, along with an IRB-approved cover letter that outlined the nature of the research to potential participants. Participants accessed the survey after they had reviewed the cover letter. After participants had completed the survey they were asked if they would be willing to participate in a follow-up interview to further elaborate on their responses in greater detail. These interviews comprise the second of my two data collection tools. The multi-modal interaction with my study participants allowed me to get focused answers to selected questions through the survey while still allowing for the individual voices of my participants to be heard in the interviews. Plumb and Spyridakis (1992) note, "When possible, the wise researcher uses a combination of research methods to obtain converging evidence" (p. 626). Utilizing both survey and semi-structured interviews allowed me to collect data that were comparable. Additionally, the process of member checking enabled me to have a more nuanced understanding of the actual engagements that my participants experienced with their technology and the assurance that my interpretations of their words was accurate than would've been available with only survey or interviews.

I met with 14 participants and conducted a series of semi-structured interviews to gain greater insight into the nature of their engagements with wearable technology during racing and training. After the first round of interviews had been concluded and the data had been coded and analyzed, I contacted four of the participants that I had interviewed and asked if they would be willing to

participate in a second interview. The purpose here was to double check my understandings of their statements during the original interviews and offer them the opportunity to correct any errors on my part or to expand on their original answers. Three of the four replied and agreed to talk again. One of these meetings was conducted face to face. The other two were conducted over the phone. All four interviews followed a similar protocol as the initial round of interviews. In advance of our discussions I included a copy of the original transcript for participants to review. I began our conversation by going through the content of the previous interview with the participant. This time, though. Rather than ask them to expand upon their comments, I provided them with my interpretation and asked them if my understanding was consistent with what they had meant to say. In some cases, this prompted further explanation from the participant that added context or elaborated upon the situation in a way that the original conversation did not warrant or encourage. As the interview concluded, participants were asked if there was anything that they forgot to mention during the initial interview, or if there was anything that they would like to add These interviews lasted approximately 30-40 minutes.

Population and Sampling

The Tampa Bay area has a thriving triathlon community, as it is located in close proximity to a number of swimmable bodies of water, numerous bike and run friendly trails and roads, and offers a year-round temperate climate, thus presenting an ideal setting for the multi-disciplinary nature of the sport. As a result of the

naturally provided infrastructure, there are a number of active triathlon teams[8] in the area that race and train together. Though there are several professional athletes in the area, my research was limited to amateurs.

In order to recruit subjects for my study I contacted the owner of a multi-chain bicycle shop in west central Florida that fields an amateur triathlon team of over 300 members. I chose this team because it is comprised fairly equally of men and women, and all age and skill levels are represented both on the team and at the races where they compete. Additionally, their members are active participants in both local and destination races and compete in both long and short course distances[9].

The team manager agreed to make a survey available to her team members through the group's private Facebook page. She posted a solicitation for my survey that contained a link to a webpage containing the IRB approval information from USF and an explanation of this study. At the bottom of the IRB letter was a link that took potential participants directly to the survey, which was posted on the Surveymonkey.com website. As per the guidelines set forth by the IRB office and

[8] It is difficult to provide a comprehensive number of teams, as there is no official catalogue that accounts for every team in the area. However, as of this writing, there are four teams in the Tampa Bay area that each have over 300 members.

[9] Short course triathlon refers to any distance up to and including the international, or, Olympic distance races. The "sprint" distances, typically .5-mile swim, 12-mile bike, and a 3.1-mile run. Olympic distances are typically 1500-meter swim, 24-mile bike, and a 6.2-mile run.
Long course distances are typically referred to as Half and Full Iron distances. These are comprised of a 1.2-mile swim, 56-mile bike, and a 13.1-mile run for the Half, and a 2.4-mile swim, 112-mile bike, and a 26.2-mile run.

explained in the IRB letter,[10] clicking the link that took participants to the survey constituted informed consent.

The initial survey was posted on Saturday, July 7th, 2018. It allowed me to quickly get a big picture view of whether/how participants interact with technology during their participation in and training for triathlon. The survey consisted of five simple questions that asked participants to indicate which wearable technologies they used, which metrics they tracked, how long they have tracked their metrics, their level of expertise, and whether or not they would be willing to meet for an interview[11]. Participants were asked multiple-choice questions and were able to select their answers from a series of options that listed commonly used devices. There was also space to fill in extra information/choices that the survey did not anticipate. The survey was intentionally kept short so that it would not be burdensome to participants, hopefully increasing the completion rate. The SurveyMonkey.com website reported that the average time spent on the survey was 2:38 minutes and that the completion rate was 100%.

Through this instrument I was able to gain high-level insight into which devices were used, and how common the utilization is. Plumb and Spyridakis (1992) argue that "survey research has the advantage of ecological validity: it asks questions of real people in real situations. […] While the self-report nature of survey research poses both advantages and disadvantages, it may be the best way to determine attitudes and beliefs" (p. 626). By engaging directly with my participants in a relatively unobtrusive manner I was able to gain a first-hand knowledge of what

[10] See Appendix A for IRB cover letter.
[11] See Appendix B for survey questions

devices were being most regularly utilized, and by whom. The survey outlined the broad contours of participant engagement with technology, creating a backdrop for the interviews, allowed me to get a more nuanced picture of the actual interactions between athletes and devices in practice.

The survey remained active and available to responses from team members for two weeks after the original posting on Facebook. After that time, it was removed, as I was concerned that the request would have fallen far enough down the Facebook news feed to no longer garner significant attention from the team. This assumption proved correct, as the overwhelming majority, 55 of the responses, came in over that first weekend. Only seven participants took the survey over the course of the following 10 days.

In total, 61 people responded to the questionnaire. 39 indicated that they would be willing to participate in a follow-up interview to discuss their responses in more detail. These 39 people became the participant pool from which I selected my interview participants[12]. The 39 participants who indicated that they would be willing to participate in a follow-up interview to elaborate on their answers were separated from the original list of participants and organized chronologically, according to when they had responded to the survey. This list, in this order, was then run through to the random sequence generator at random.org. The result was a totally randomized list of survey respondents that had indicated that they would be willing to further discuss their use and experience and interactions with wearable technologies in triathlon with me. I felt that a randomly determined list

[12] See Appendix B for a list of the survey questions.

was appropriate, as I wanted my selection process to produce a participant pool that was unbiased. Curtice (2016) argues that random sampling is a reliable method for gaining a representative understanding of attitudes and beliefs

> As long as a sufficient number of people have been selected for interview, the views expressed by those who are interviewed (assuming a fair proportion of those who are selected actually participate) should provide a reasonably accurate portrait of the distribution of attitudes in the population at large (p. 4)

Ultimately, I believe that my list did return a population that is typical of those that would likely participate in an amateur triathlon in regard to age, and ability. While the gender distribution was not exactly in line with the statistical norms of triathlon, both male and female participants were represented in nearly equal numbers.

The survey asked participants who were willing to talk to me to indicate the best manner for contacting them. Utilizing the information that they provided, I sent requests for follow-up interviews to the first 20 people on the randomized list through a combination of email and text messages. 14 of them responded to my solicitation and I was able to set up interviews with all of them. Despite multiple attempts I was unable to make contact with the remaining 6 participants to set up meetings with them. Over the following two weeks, in July 2018, I conducted all 14 interviews with my participants. Details of the survey and interview process will be discussed below.

Participants

The primary concern with my methods was data collection. Ultimately, I settled on random sampling, as it provided the most easily defensible method to avoid biases such as gender, age, skill level, and income. Certainly, there are limitations involved with this approach as I cannot be guaranteed a perfectly representative sample and the possibility of a skewed participant pool is real. Ultimately, my participant pool was skewed towards female participants (8 female/6 male), but not unreasonably so. USAT, the governing body of triathlon, reports a 65% male to 35% female gender breakdown. All of my participants were between the ages of 30 and 60, groups, which make up the 6 largest age groups of registered members[13].

Additionally, I had concerns over some of differences among the participants impacting the responses that they provided. However, my fears turned out to be unfounded. Of the 14 members surveyed, 2 identified as novice, 8 identified as intermediate, and 4 as advanced. Interestingly, all members reported using similar equipment as far as their engagements with technology are concerned. Each participant reported using a wrist-based device as their primary point of reference with other devices that provide advance metrics differing somewhat on an individual basis. As such the differences in technology use were mitigated by the fact that all participants reported using a wearable device. In all cases, this devise functions as a display for any and all other devices worn. So, in that regard I was able to achieve something fairly close to an even comparison amongst my

[13] See Appendix C for participant table

participants. Additionally, as each of the 14 participants was asked the same core set of questions regarding their engagements with technology, holistically speaking, I was able to record narratives that were comparable. The differences among participants largely entailed what they did and how they responded to their data, not what data and technologies they relied upon.

Finally, I was concerned that my own participation in triathlon would potentially impact the manner in which participants responded to my questions. To avoid conflicts here I intentionally sought out a triathlon team with which I had no previous affiliation. As such, I was not directly familiar with any of my participants, nor they with me. At the conclusion of several of my interviews I was asked by my participants if I "did triathlon" but by that point the interview had concluded and the recording had been turned off. In none of those instances to my answer prompt any negative responses. My concerns appear to be unfounded.

Interviews

The survey was utilized primarily as a means of accessing an appropriate participant group and assessing who would be willing to talk to me. The content of the survey was intentionally simple and was not designed to elicit deeply engaged responses. It was as much an ice-breaking mechanism as anything else. The main source of data collection was the interview which Bertrand and Hughes (2005) note is a particularly useful tool in qualitative studies such as this because they "allow people to respond on their own terms and within their own linguistic parameters"

(p. 196). Through the survey I was able to tap into a willing group of participants who were appropriate for my study.

Once that time had passed I was able to make contact and schedule the first seven interviews, all of which were completed within the same week that the initial request for a second interview was sent out. One week after the first seven interviews were completed I sent out seven more requests. These interviews were completed over the following ten days. The first interview was conducted on July 17th, 2018 and the final interview was conducted on Friday, August 3rd 2018. All of the interviews were recorded using a voice-recording app on an iPhone. Additionally, where applicable, a back-up recording was captured on my laptop computer using a similar app. These recordings were then transcribed using a service called Temi and then double checked for accuracy manually. At this time, all participants were also given a pseudonym, in an attempt to keep their identity private

Originally, it had been my intention to conduct all interviews in person. However, it quickly became apparent that, while my participants were very willing to speak to me, scheduling a time and place to meet personally would be a challenge. In the end I was only able to meet with five of my participants face-to face. The remaining 9 interviews were conducted over the phone. A considerable number of methodological publications (Brustad, Skeie, Braaten, Slimani, & Lund, 2003; Gano-Phillips & Fincham, 1992; Groves, 1979; Hoppe, Gillmore, & Valadez, 2000; Pettigrew et al., 2003) indicate that there is a negligible impact on data derived from phone interviews. Block and Erskine (2012) note, "The majority of studies report

that there are few differences between data collected by telephone as compared with traditional interviews, diaries, and mail surveys" (p. 431). The face to face interviews were conducted at times and locations of the participants choosing. Similarly, the phone interviews were scheduled at times and dates that were chosen by participants. There was no noticeable difference between the quality of the interviews that took place in person and those that were conducted over the phone.

Mats Alvesson (2003) identifies two basic orientations to the interview process, the so-called Neopositivist and the Romantic.14 Each of these positions imposes an ideological framework on the data and its collection, with the Neopositivist studying "facts" and Romanticism focusing on meaning. As I understand the interactions with wearable technologies to be highly individualized affairs, I chose to adopt a Romanticist approach to the interview process, utilizing a series of open-ended interviews with participants to understand how and why they engaged with their wearable technologies as they did. My hope was to establish a more "genuine, human interaction"(p. 16) with my participants in hopes of establishing what Miller and Glassner (1997) call a "deeper, fuller conceptualization of those subjects' lives we are most interested in understanding" (p. 103).

Regardless of whether they were conducted face-to-face or over the phone, the interviews lasted between 35 and 45 minutes. I utilized a semi-structured interview format with the hope of creating documents that were comparable to each other while still allowing for my participants to elaborate on aspects of their

[14] He does allow that these two positions exist as poles, that there is a considerable amount of variety between these two positions.

engagements with wearable technology where they felt it was necessary. Kvale and Brinkmann (2009) note that this method is particularly effective because it "is flexible, accessible and intelligible and, more important, capable of disclosing important and often hidden facets of human and organizational behavior" (p. 246). Each interview began by recapping participant answers to the survey. Once we had reviewed their answers with them I asked them to elaborate on their choices for deciding upon and utilizing the technology that they had chosen. In this way, each interview started off in much the same way. However, participants were able to discuss their devices and how they interact with them in ways that were interesting and relevant to them. Because of the way that the interviews were conducted, the conversations often jumped around and became non-linear. In these instances, I opted to follow the lead of the participants, letting them determine the direction of the conversations. I did not predetermine what the conversation would look like or an absolute direction for it to follow. When a tangent had run its course, I tried to resume the previous thread by returning to the survey questions as prompts. In this way, there was structure, which allows for comparison across all 14 interviews. However, this method also allowed them to initiate new topics, which, in some cases, were highly productive in illuminating the impact of wearable technologies on their training and racing.

At the conclusion of each of the interviews I allowed time for my participants to ask me any questions that they may have had about the project, its purpose, or anything else that they were curious about. In general, the questions they asked at

this point were fairly benign, inquiring as to what trends I was noticing and what, exactly my project was.

Four of my participants indicated that they had enjoyed the discussion and that they would be willing to talk again if I had any other questions. These participants were then identified as candidates for follow-up member-checking interviews that were conducted to verify my interpretations and gain an even more detailed understanding of the interactions with wearable technologies in triathlon. The follow-up interviews were conducted after the coding my analysis was completed.

Data Analysis: Transcription and Coding

Once the initial interviews were complete they were transcribed using a computer application named Temi. I uploaded audio recordings of the participant interviews to the Temi website and they emailed me a transcribed copy of the interview. Upon sitting down to analyze the transcripts it became clear very quickly that the software that transcribed the content was not terribly accurate and did not accurately represent the language used in the interviews faithfully. I used shortcoming as an opportunity to further immerse myself in the data. Before attempting to code any of the transcripts I first went back and, while listening to the audio, double-checked the transcripts for accuracy against the actual recordings. While this was a very time intensive process, it was one that ensured that I was very comfortable with the data. Charmaz (2006) states, "coding full transcriptions can bring you to a deeper level of understanding" (p. 70). In this instance I certainly

found that to be true. In total, the initial round of interviews and the subsequent member checking produced a total of 18 distinct transcripts, each between 15 and 30 pages long. Ultimately, this study produced over 325 pages of text from the transcriptions.

After the transcriptions were cleaned up they were loaded into the Nvivo software and coded for themes common among all of the discussions. The process of reaching my final codes was achieved in two steps, which is consistent with the process laid out by Charmaz (2006), when she says

> Grounded theory coding consists of at least two main phases: 1) an initial phase involving naming each word, line, or segment of data followed by 2) a focused, selective phase that uses the most significant or frequent initial codes to sort, synthesize, integrate, and organize large amounts of data. (p. 46)

My initial round of open coding produced far too many codes to be actionable as I focused primarily on identifying the different themes that came up in the interviews, rather than connecting them. I was able to identify over 50. While this step did not directly lead to any of the codes that were ultimately used in the data analysis, this was a productive step in that it gave me a thorough understanding of the data moving into the second round of coding.

Where the initial pass through the interview transcripts revealed the various themes that were discussed individually, the second round of focused coding was centered on identifying common patterns across all of the interviews. Charmaz (2006) states, "Through focused coding you can move across interviews and

observations and compare people's experiences, actions, and interpretations. Note how the codes condense data and provide a handle on them" (p. 59). It quickly became apparent that, while each participant talked about their engagements with the technology in fairly idiosyncratic ways, there were similarities in terms of how the devices functioned in terms of the decision making processes and relative to larger questions of agency. Ultimately, these patterns coalesced around three different relationship models. I decided upon three codes, representing larger patterns or themes: Translation, Cooperation, and Feel. These codes later became the patterns/themes discussed at length in the following analysis/findings chapter.

Summary

The survey instrument was designed to provide insight into the use of wearable technologies by amateur triathletes. My goal was to better understand the interplay between the device and the athlete and, utilizing new materialist theory, understand the degree to which racing and training decisions are collaboratively determined.

The subjects of this research project were members of a multi-chain bicycle shop triathlon team in west central Florida. I contacted them by reaching out to the owner of the store who, in turn, posted a request for responses to my survey on the group's private Facebook page. There are currently just over 300 members on this team, 62 of whom responded to my survey. Out of the 62 who responded to the survey, 39 indicated that they would be willing to participate in a follow-up

interview to discuss their use of technology in greater detail. These people were then randomly chosen for interviews.

The data gathered from the survey and interview was both quantitative and qualitative in nature. I sought and received quantitative measurements regarding the numbers of devices used and the metrics that athletes chose to track. Qualitatively, I focused on the manner in which athletes engage with their devices through a semi-structured interview format.

Chapter 4. ANT and Network Analysis: Following the Actors

Actor Network Theory

ANT provides an invaluable lens for investigating the nature and impact of the relationships between human and nonhuman actants in the use of wearable technology during athletic performance. The purpose of new materialism generally, and ANT specifically, is to shift our understanding of relationships between human and nonhuman actors from a vertical orientation that privileges human sentience over inanimate object, to a horizontal arrangement that focuses on equal relationships between both actants. It's helpful to apply Latour's understanding of ANT to our interactions with and understanding of wearable technologies.

Latour (2005) claims, "it's so important to maintain that power, like society, is the final result of a process and not a reservoir, a stock, or a capital that will automatically provide an explanation" (p. 64). He sees things like power, action, and intentionality as end products of relationships, not as properties of matter. Latour argues that there is no such a thing as inherent power. Rather, power is the product of complicated processes, the result of intricate interactions among myriad actants that can only be determined and understood after it has been produced. In other words, what are often misunderstood as inherent properties or essences in an actant are actually the products of its interactions with other actants. Latour (2005) calls these interactions, these moments of coming together, social. He says, "We use 'social' to mean that which has already been assembled and acts as a whole" (p.3).

That assembled social produces effects that we then understand as agency, or power, or action.

> ANT […] wants to show that between the premise and the consequence there exists a huge gap, a complete non sequitur. For the social sciences to regain their initial energy, it's crucial not to conflate all the agencies overtaking the action into some kind of agency— 'society', 'culture', 'structure', 'fields', 'individuals', or whatever name they are given—that would itself be social. Action should remain a surprise, a mediation, an event. It is for this reason that we should begin, here again, not from the 'determination of action by society', the 'calculative abilities of individuals', or the 'power of the unconscious' as we would ordinarily do, but rather from the under-determination of action, from the uncertainties and controversies about who and what is acting when 'we' act. (p. 45)

When Latour argues that there is a gap between premise and consequence he urges us to repress the impulse to ascribe agency to a single actant and to realize that where we see agency or affect, we are never looking at a single actor. In instances of agency, rather than looking at individual actors, we are always looking at collectives. He states clearly that agency can never be the product of a single actant. In Pandora's Hope (1999) he claims, "Purposeful action and intentionality may not be properties of objects, but they are not properties of humans either. They are the properties of institutions, of apparatuses" (p. 192). ANT allows us to investigate these institutions and apparatuses that produce power and agency more deeply. By ascribing agentive potential to non-human actors, the role that they,

along with their human counterparts, play in determining the nature and scope of agency comes more clearly into relief.

Latour argues that the compositions of networks (and, thus, their agentive potential) are dynamic. Certain agents will come forward and others will recede, and in these shifts, agency is enabled. In any scenario there is always an actant or collective of actants that is most heavily influencing the network. Their presence and assertiveness are not equally and fully distributed among all that comprise the network. My argument in this study is that wearable technologies possess agentive potential – they are capable of actively impacting the manner in which the network that is the collective human body and mind in athletic performance behaves. In some cases, these collectives of actants may induce or prevent activity more forcefully than others.

ANT posits that agency is the result of the socialized combination of actants, what Latour refers to as collectives. Because of the persistence and persuasiveness of the Cartesian model, it's easy to mistake the agency of the collective for intentionality of the subject as, when the collective functions properly and in ways that we understand, we are tempted to see the collective as a singular entity. Latour (1999) refers to this phenomenon as black-boxing, "a process that makes the joint production of actors and artifacts entirely opaque" (p. 183). However, Latour does offer that we can open any and all black boxes and in doing so their complexity and composition are momentarily revealed to us.

I take it as a matter of fact that the networks that exist in any given moment are too numerous and heavily black-boxed for any full and complete accounting.

However, these black boxes allow us to understand the manner in which non-human actants shape what has traditionally been viewed as the province and privilege of human actors in understanding agency through the ability to act. Typically, we become aware of black boxes (and peek inside, glimpsing their complexity) when the collectives break or otherwise fail to perform as anticipated. This delving into the workings of networks follows what Heidegger calls "present to hand" and what Dreyfus refers to as "skillful coping" – moments when the complexity of "things" become real to us in their failure to perform as expected.

By way of example Latour (1999) offers the scenario where an overhead projector is being used in a presentation. Its presence goes largely unnoticed until it breaks. Upon its "malfunction," technicians are brought in to "fix" the projector. Here, the black box is opened and the projector goes from being a singular actant to one composed of many others. The collective is revealed where we had originally supposed a singular actor. Equally important, though, we see that in this revealing, "goals are redefined by associations with nonhuman actants, and that action is a property of the whole association, not only of those actants called human" (p. 183). The original goal, a presentation, has been shifted to repairing the black box that was the projector, which may then shift again to addressing the individual things that come together to compose the projector. Depending on the interactions, additional, smaller black boxes may be opened, revealing additional relationships. "The projector may count for one part, for nothing, for one hundred parts, for so many humans, for no humans – and each part itself may count for one, for zero, for many" (p. 184). At any point in time we see that the number of actants in any

collective is in flux, depending upon the goals imposed by the whole. It becomes clear here what Latour means when he claims that "no tie can be said to be durable and made of social stuff" (2005, p. 66). The very nature of any collective is always going to be in a state of flux, with new actants entering the collective and other leaving as warranted by whatever goals and objectives matter most to the whole. When the dysfunctional tool is repaired or replaced or otherwise circumnavigated, we close the black box and, in Heideggerian terms, things return to being unremarkable, or, "ready to hand."

To make sense of the continual (and unavoidable) shifting nature of social collectives, Latour argues that ANT requires us to focus on the parts rather than the whole. Its slogan, "Follow the actors', becomes, 'Follow the actors in their weaving through things they have added to social skills so as to render more durable the constantly shifting interactions" (p. 68). In tracing the coming and going of the various actors that comprise the social collectives it becomes possible to understand what actions are enabled and foreclosed upon as a result of the social composition. Understanding this point is crucial as it explains that any given actor will find themselves in changed orientations with the other actors that comprise the collective as it shifts. The result of the dynamism is twofold. First, as we have seen, agency is the result of interaction with other actors. As such any rearrangement among the collective is going to affect the range and nature of impact that a particular actant is going to assert on the collective. What can be done by the whole is changed as the positions and roles of the constituent parts are adjusted. Second, as a result of the changed agencies, the responsibilities of all actants changes. The

significance of the roles that each actant plays is directly tied to its orientation to the others in the collective.

The Networks of Wearables

The nature of the interactions between human and non-human actors frames the use of wearable technologies as sites that entail multiple agentive actants. These networks serve as clear demonstrations of the ways in which ANT functions. Through close scrutiny of the interactions among actors in these networks it becomes possible to see the binary distinctions (subject/object) as limiting, inhibiting a full understanding of the interactions among actants. Rather than adopting the subject/object relationship, it is more productive to conceive of these networks of actants as collectives. And while we may be tempted to privilege a human actor wearing and using a wearable technology as the subject, Latour (1999) is clear that "The attribution to one actor of the role of prime mover in no way weakens the necessity of a composition of forces to explain the action" (p. 182). What my research has clearly shown is that there are non-human actants that, in certain circumstances, function as prime drivers of action. Herndl and Licona (2007) invoke Kenneth Burke's pentad as a means of articulating the shifting role of an actants in terms of agency.

> Burke's fundamental point in A Grammar of Motives is that the rhetorical events result from a complex relation of elements, no one of which is primary. […] Burke's theory suggests that agency – in our terms rather than his – is the conjunction of the five elements of the pentad. Agency is the

> conjunction of all the ratios in a rhetorical context. As Burke says, some rhetorical elements depend more on one ratio than on others. (p. 14)

They argue that agency is manifest in the engagements from all members of the whole. As circumstances/goals dictate/change – as Burke's ratios are reconfigured – the roles of individual actants change and new actions are enacted. Latour, (1999) continues, "Action is simply not a property of humans but of an association of actants […] provisional "actorial" roles may be attributed to actants only because actants are in the process of exchanging competences, offering one another new possibilities, new goals, new functions (p. 182). Each interaction of human and nonhuman actors creates a new opportunity for goals and objectives to be altered and expressed. In these moments, new collectives may or may not form, depending upon the durability of the network and the stability of the goals.

Before I get too far into discussing the individual networks I think that it's best to clarify the observed and accounted for actants that are common to each of the three networks. As I have previously noted, it would be impossible to take a full inventory of all actants in any of these networks for a few reasons. My study was not a controlled one in the sense that I did not try to create a situation where the external factors around the engagements with the devices was kept constant. As such, actants such as weather, location, other athletes, other electronics, etc. are not specifically accounted for but are likely influential and could have an impact on network function. These actants can play a significant role in any of the network scenarios outlined in this study. I will offer a few short examples below.

Leading up to an event, it is very common for athletes to take an exaggerated interest in local meteorological conditions. High temperatures will likely have a negative impact on athlete's physical abilities as well as their enthusiasm for participation in an event. The end result is often a diminished performance. Cooler temperatures allow the body to perform at heightened levels of intensity for longer periods, yielding improved performances. Many of the devices that my participants use can monitor and display current temperature and forecast future weather conditions. The awareness of these actants (or failure to account for them) has a tangible impact on performance.

Similarly, the atmosphere at higher altitudes contains less readily available oxygen for the body, negatively impacting the capacity for sustained endurance efforts. However, after a few days' time spent at altitude the body adjusts, increasing red blood cell counts, normalizing performance (or improving performances at lower altitude) by altering the body's ability to transport oxygen to the muscles and other organs. Athletes who train in one location and race in another (or who are un/lucky enough to catch a shift in weather patterns) are subject to the presence of new actants that will have a bearing on their ability to function on race day. As these cases make clear, human intentionality comprises a very small portion of network makeup and the dominant actants and resultant agencies. An athlete seeking improved endurance could travel to altitude and, in his or her compromised state (before the body responds by producing additional red blood cells) become ill. The list of actants and the contours of potential networks are simply too great to account for, even in the most strictly defined contexts.

It is, of course, impossible to fully account for an absolute total numbering of actants in any rhetorical situation, as each is its own black box that may be opened and scrutinized. However, it is possible to account for a manageable number of black boxes in a defined collective; we can follow the actors. The interactions among these can be traced and, as one comes to the forefront and another retreats to the background, their orientations can tell us much about what actions are enabled and disabled. Latour (2005) admits as much when he says:

> Although there exists an indefinite list of groups, we could devise a small list of handles allowing the sociologist to move from one group formation to the next. In the same way, I think it is possible to propose a limited set of grips to follow the ways in which actors credit or discredit an agency in the accounts they provide about what makes them act. (p. 52)

While each interaction is, by the very nature of a collective, a temporary and unique set of engagements that yields independently unique results, all interactions stem from the same set of actants. Furthermore, as we have already seen, the orientation of the actants in relation to each other produces its own set of affordances. It is possible, by virtue of dealing with a small set of actants, to identify a manageable number of networks that can be scrutinized to determine what is enabled. From here it is then possible to make claims about how the arrangement of actants enables their function in one way or another. In other words, by identifying the number and orientation of actants in a network it is possible to make claims about how they function and what they make possible.

For this study and the definition of the networks that emerged from it, there are three primary black boxes: device, body, and mind. It's necessary to clarify what each of these terms means and how it is being used before proceeding much farther.

Device

In using the term device, I am referring to any electronic object that is connected to, measuring, and reporting inputs in relation to physical exertion of the athlete. For the athletes that participated in this study that meant the following devices:

- A watch, worn on the wrist. These devices typically record and report metrics such as rate of speed/running pace, distance traveled, elapsed time, heart rate (sometimes recorded from the watch itself, sometimes through a heart rate strap worn across the chest), and cadence (either in terms of foot speed while running, revolutions per minute while cycling, or strokes per minute while swimming).
- A power meter, attached to the bike, not directly visible to the athlete. Though not directly attached to the athlete, these devices record and report the amount of force that an athlete is applying to the pedals as they ride their bike, measured in Watts. This information is sometimes displayed on the watch but is more often utilized in conjunction with a bicycle computer.
- A bicycle computer, attached to the bike at either the stem or the aero bars. These two locations comprise a portion of what is commonly referred to as the cockpit of the bike – the area at the front that is used for steering. The

computer is placed here because it is easily visible while riding. It is generally considered preferable to a watch as it is safer to look at and does not require any unnatural movements or postures to be made visible. This device is typically used in the same way as the watch, to display metrics such as speed, location, distance traveled, time, power, cadence, and heart rate.

- There are other, occasionally referenced devices that were used, such as heart rate straps, running power meters, and a swim aid. However, in all cases, interaction was always conducted with either the watch or the computer as the conduit.

Body

When I speak of "body" I am referring specifically to the physical body, separate from its cognitive processes. This is the non-thinking, just-experiencing aspect of the self.

Triathlon is a unique sport in that it is comprised of three disciplines: swimming, biking, and running. Each of these activities utilizes separate muscle systems that are fatigued in different ways. As a result, the perception of the body is going to be different from one discipline to the next. Having to focus on different types of engagement with terrain and equipment produces different sensations, especially when these activities are performed in succession. The cumulative effect of these differences, especially in the longer distances that many of my participants regularly participate in produces an effect where sensations from the body are very different than they would be under different, less strenuous conditions.

Mind

For this analysis I have chosen to separate the mind from the body for pragmatic reasons. If the body is the recipient and transmitter of physical sensations (explained in the following section), the mind becomes a necessary other to interpret them. In this way, the mind works as an analog to the electronic devices. It does not experience anything (the body does that). Its sole function is to interpret the experiences it receives from the body.

The Three Networks

With these three actants identified I will move into my discussion of the three networks that my study revealed. I have identified them as: Feel, Cooperation, and Translation. We will address each one individually before discussion the manner in which the shifting of actants moves us from one network to the next. Latour (2005) is clear that networks are not static entities. "No tie can be said to be durable" (p. 66), that actants emerge and recede into the background as the network evolves and changes. As this happens, given the shifting relationships among actants, the nature of the network changes, in turn impacting what is possible. In this way, the goals of the network change. He calls this shifting process mediation, an act of transformation that changes all members of the network. This is how athletes move from one network to another in their use of wearable technologies, often many times over the course of a single activity.

One of the questions in the initial survey asked participants to self-identify as either beginner, intermediate, or advanced in regard to their participation in

triathlon. In my follow-up interviews with participants I asked them to explain the rationale for their ranking decisions. The answers were predominately drawn along one metric, time. Participants understood time in relation to their identification in two ways: The faster an athlete was able to get to the finish line, the more advanced they considered themselves. And, secondly, the longer an athlete had been doing triathlon the more advanced they considered themselves. This is significant as both understandings of time and, thus, proficiency, carry with them an implicit understanding of the body, one of the actants in the various networks. Generally speaking, the more in tune the participant was with their body – the more effectively they were able to recognize and interpret information sent from the body, the more access they had to the Feel network. Conversely, the less aware of their body, the more likely an athlete was to exist in the Translation network. After first discussing these two networks I will discuss the Cooperation network as implications from the functioning of the other two profoundly impact the manner in which the three actants engage and make meaning come in to play there.

Feel Network

Training and racing by feel was the least common scenario among the participants in my study. This is not particularly surprising, as the purpose of the study was to investigate the use of wearables and the impacts that they have.

The Feel network (Figure 4-1) understands mind and body as being in engaged in reciprocal communication with the mind. As the body experiences sensations (pain, fatigue, euphoria, etc.), they are relayed to the mind, which then decides upon a course of action. This course of action is then either attempted or carried out by the body.

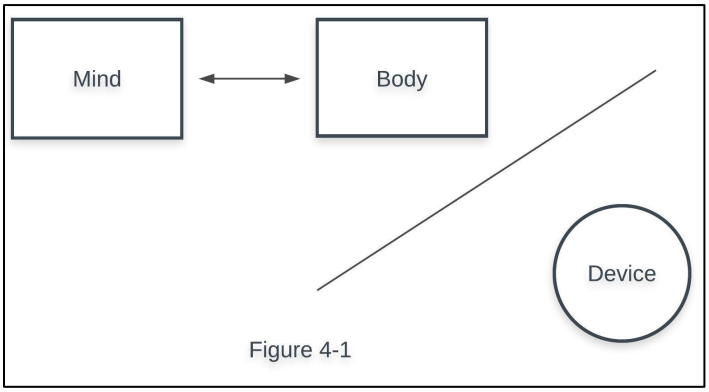

Figure 4-1

In this scenario the device has not been socialized with the mind and body and any input from the device is not attended to or accounted for. This scenario is commonly referred to as "going by feel" in athletic circles. As a general rule, discussions of feel tend to be very qualitative, rather than quantitative[15]. Mark, one of the participants in this study who engaged in endurance sports and triathlon before the advent of modern wearable technologies talked about how all of his training was done by feel.

I have logs all the way back to 1980. I can show you; in every log you'll just see time and perceived effort. So, so my standard one was a, uh, X amount of time and then I would either ah, it was either "good", "okay" or "uggh" that was my how I felt. And,

[15] Recently, online training programs and logs have begun to incorporate quantitative measure that athletes can add to their workout descriptions. However, in these cases all metrics are still individually based and do not translate from athlete to athlete as other metrics such as pace and time would. Additionally, as of this writing, there is no mechanism in place for any of these programs that I know of that functions to normalize workouts for a 1-1 comparison. In other words, though companies have begun to try to quantify the "feel" levels of endurance workouts, such endeavors are still very much in formative stages.

and, and then it was either ah, you know, a “hard” “moderate” or “easy.” And, and that was it

Of the three networks that I have identified as a part of this study, Feel (Figure 4-2) is the simplest, but also the most imprecise. In order for this network to function in a way that produces optimal results, an athlete must have a highly developed sense of their body and its potential and be able to account and adjust for the other variables that were discussed briefly, earlier. They must understand and be able to determine the difference between particularly nuanced signals that may be the result of other actants outside of the collectives of mind and body. Without the device to provide an accounting of external inputs, it becomes more important to account for factors such as topography, climate, past training, present context, etc. These are variables that less experienced athletes have generally not yet learned to account for and, as a result, rely upon a device to provide that information. When a less experienced

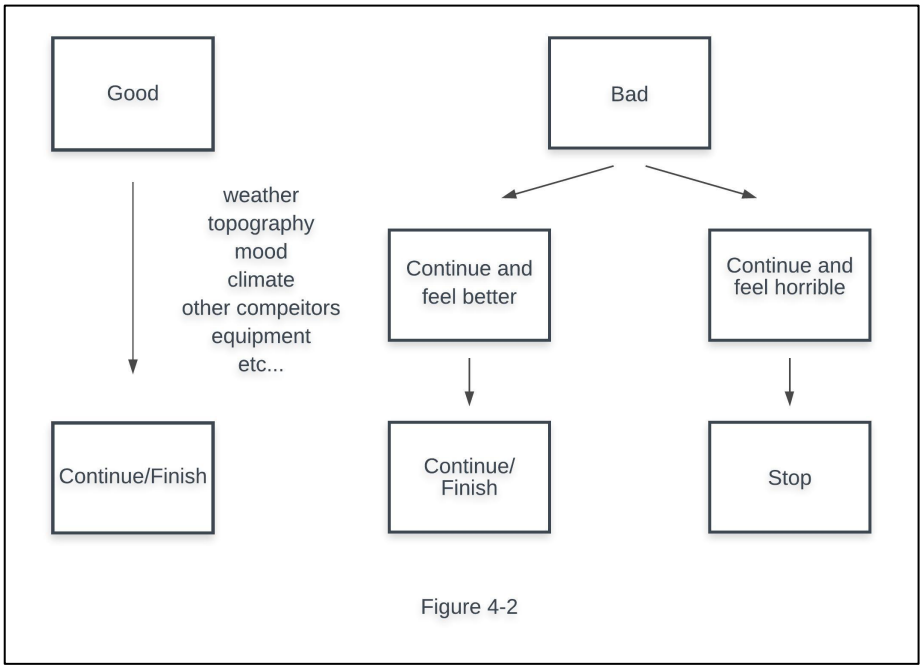

Figure 4-2

athlete finds themselves in the feel network their ability to execute a predetermined plan is compromised.

Engaging in the Feel Network

Lucy, one of the participants who identified as being an intermediate athlete but a "back of the pack" competitor – someone who typically finishes their races in the latter 20% of the field – explained the problems of running by feel in the following way

I mean because you don't know what you're doing. So like, I mean, you're going to do it just same with running. You're going to do it by feel and if you start to feel tired, I mean just there's no way that. Well, I mean I guess there is a way, but in my mind there's not really a way to like judge, like how far you've gone or where the courses are. Like you'll probably end up being in a race situation. I don't know. I mean for me, I'd probably end up being a little bit more conservative just because like I have no idea how much longer I have to do this and I have like this self-preservation default for some reason or another. Um, I'm not one of those people that can be like collapsing on the finish line. I'm like, that does not sound fun to me. Um, I say this is, and I'm like, I went too slow.

Lucy's understanding of racing by feel is interesting. Without the device she fears that she wouldn't have any idea how far she had gone or how far she had left to go. It is immediately clear that she has offloaded responsibility for the key aspect of racing and training– distance – to the device. She has not developed a sense of this and clams that there is "no way to judge." As a result of this she is then hampered farther in her ability to pace herself, as this is directly related to distance. Lucy feels

that she would be "too conservative," arguing that her "self-preservation default" will keep her from performing to her potential, which becomes a necessary outcome as the only other available option for her is "collapsing at the finish line" – a result we assume comes from, again, pacing poorly and pushing too hard. There is no middle ground for her and, in the end, she says she'd probably go too slow.

This understanding, that the body is prone to underperform when called upon to go purely by feel, was repeated several times, across most of the interviews that I conducted. Steve said, "Without a plan, you know, the instrumentation and my point of view is it's as good as you feel in the moment. […] I think that people will underachieve as a result of that."

When I pressed him further he was more deliberate in his explanation:

Interviewer: how would your training be altered if you did not have the devices to rely upon?

Steve: I would underachieve. Yeah, I know it works for some people; it just doesn't work for me. I'd probably end up just kind of fizzling out, slowing down, probably not being as competitive as I am against myself. I don't know the answer. I'm afraid what I would do without the devices is we'd go to hard at first and, uh, burnout I, and I'll tell you, I know guys that ended up in run/walking modes in their runs without devices. I think I would go harder to answer your question and then burnout. I would train, I suspect too hard or too slow and that would frustrate depending on the day, and would frustrate that I couldn't measurably identify, um, if I'm improving. Because it would be day by day […]. I might have a great week and then the worst week

of my life and had to start all over again. I that's random to me, I can't handle that. It's a mental thing for me.

Again, we see the same articulation of the device functioning as a guide, acting as legitimizing mechanism that sanctions high effort performance levels that the athlete would otherwise avoid or recklessly engage in and then fizzle out of. It became clear that many of the participants in the study did not have a sense of their bodily potential that was acute enough for them to feel that they were maximizing their potential.

One of the more interesting findings that surfaced in relation to the Feel network, that has already been hinted at in this discussion is the notion of distance. It appears that as the distance shortens and there is less to try to track, mentally, that some athletes were willing to do away with their devices and engage more with Feel. Again, though, this was the province of the more highly seasoned participants.

Mark, a very seasoned triathlete who self-identified as expert as a result of his successful participation in multiple Ironman distance races[16] among his other notable athletic achievements was generally receptive to the idea of racing by feel in certain circumstances.

Sometimes what I do, like when I do a sprint tri, I don't even take the Garmin. It's not worth it. Just don't take it. It's just, you know, full and go. Because you should be pressing all out. Don't waste your time looking at the thing. It's not worth the time trying to start it and you know, a 10-mile bike ride. In most cases, 10 to 15. Like you should be going all out. A sprint is all out. What do you need a power meter for?

[16] An Ironman, or full distance triathlon consists of a 2.4-mile swim, a 112-mile bike leg, and then a full 26.2-mile marathon.

Power meter is best, it works best in long course and for me, just for me, because uh, you know, I consider myself an old school guy, I don't follow it as closely as others would. It's, it's to control my efforts. It is to make sure am I'm not getting out of the box and my burning matches[17] and pressing my power too high. Do I need to back off? And so I use it more in, for, for training, I'm chasing in it. But in racing I'm using it as a control meter, you know, control. The device keeps me into blocks for the long day out there.

What is particularly interesting here is that, despite Mark's willingness to embrace Feel, he does so with certain qualifications. First, it's important to note that, with a sprint triathlon, he's talking about a much shorter distance than the others. A sprint triathlon is, generally only 1/5 of the distance of the Half Ironman races[18] and 1/10 of the Full distance. These are significantly shorter races and his contention seems to be that issues of pacing become irrelevant, as the body should be able to operate at maximal capacity for the duration of the race. Now, certainly, his point must be taken with a grain of salt as distance, and notions of what constitutes a "long" race are highly subjective concerns. However, what is interesting here is that when issues of pacing are removed (for Mark, this means going 100% for the entire duration of the race) the devices become much less useful and may even become an impedance, not being even worth the time to set up and start. Other racers, less seasoned or less athletically fit than Mark still saw a need to

[17] This term refers to an athlete's limited ability to produce maximal efforts in a race situation. Each maximal efforts is akin to a match in a book of matches. Once an athlete has burned their final match they will be unable to produce a strong effort again on the day.

[18] The Half Ironman distance is a 1.2-mile swim, followed by a 56-mile bike leg, and then ends with a 13.1-mile run.

pace effectively in shorter distance races and so, absent a device, they find themselves compromised. Mark's argument that the devices become useful in the long course races to "control my efforts" and "keep me in blocks for the long day out there" highlight the potentially restrictive, but also potentially beneficial aspects of the device in a feel network.

There is one final aspect to operations within the Feel network that arose in the interviews. We have seen how, absent these devices, an athlete may be prone to underperform and finish with a suboptimal effort. Additionally, we have seen how the lack of a device may put an athlete in the position of overexerting himself and "fizzling out." In both situations we see that the device operates as what Latour earlier called the prime mover in the network.

The final perspective that my participants shared in regard to operating in a Feel network was that the device as the prime mover could exert a tethering effect, an emotional attachment. In none of the discussions that I had with any of the participants in regard to any of the interactions with the device was it ever referred or alluded to as an instrument of oppression. However, when I asked participants to imagine engaging in athletic activities without their wearable devices, several of my participants struggled to do so. There are several anecdotes from the interviews that would serve this point, but the following is a nice example of the pull that the device exerts, which highlights some of the difficulties of actually participating in the Feel network.

Interviewer: Would you ever run without your watch?

Susan: Yeah, I mean yeah. So like it's, I can't remember the last one I went in without it completely. Yeah, I don't, I don't think I would actually run without it. […] I'm like, the last time that I can remember running without a watch was when I forgot my watch and I almost drove for 30 minutes back home just to get it.

Interviewer: Did you, did you, you did run without it though?

Susan: No. I just had to just run with my phone, which I hate doing. I honestly don't really see... like I, I could see me more wearing the watch and just not turning on the run, but I don't see me actually completely taking off the watch and going out and running.

In this exchange it becomes clear that the device exerts a tremendous pull. So much so that Susan considered what would've been an hour (round trip) delay to retrieve it from her home. And then, failing that, she decided to run with her phone (an ad hoc wearable) to take the place of the device that she was missing. Going without was never a serious consideration here. The security of undertaking physical activity with the device as a confirming or authoritative voice is so strong for many that they can't even imagine working without it. For those that can make the leap into the Feel network, though, the results are interesting to note. While the tethering effect of the devices is strong, there is an apparent weight lifted when the activity is performed without it.

Interviewer: What is it like to go without the devices?

Lucy: I mean, it's definitely more of a feel like you're, you just kind of go out and you're not worried about it. You're just running for the sake of running. I

actually bike without it a lot more than I run without it. I don't know why I'm with biking. It's just something… I don't want to say I enjoy it more because it's not really so much that. But I feel like with the biking I could just go out and kind of just have a good time, be five years old again and, and do that.

Lucy says that riding without the device makes her feel like a five-year-old again. Others described the experience as "freeing" or "liberating." It's curious that such emancipatory language is used in this circumstance. To account for this perspective, I think that it's important to look at the nature of triathlon and the expectations that it imposes upon those who compete.

Kara, a highly competitive and accomplished participant mentioned that competition in triathlon was, for her, about getting the most out of her body.

I get more from, um, seeing what I can get myself to do and so even in a race where things are going bad, you know, like a aero bar fall off, many things happen, you know, I just try to maintain a positive attitude and try to work with what I've got. I just do the very best with what I got and at the end of the day if I've given it my very best effort for that race, now I'm happy and I find, you know, because if you focus on results, you're going to be unhappy more than you're happy, you know what I mean? And I, and I like racing, but you know, it's more about what can I get myself to do than what other people are doing.

In this passage, Kara makes several references to the shifting nature of her goals. First, she indicates that focusing on results (goals) leads to more unhappiness than sadness. Clearly implied here is that an athlete is not the only determining

actant in the constellation that becomes an outcome. There are, as I've mentioned earlier, countless other actants that impact performance and results. Building on this realization, Kara says that racing is about what "I can get myself to do." Again, the implication here is clear. There are multiple and changing actants. Latour (2005) reminds us, "In each course of action a great variety of agents seem to barge in and displace original goals" (p. 22). If this was purely about human intentionality, there would be no distinction between her desire to act and her ability to do so. However, what is possible on a given day, as she makes clear, is dependent upon the interactions of countless other actants beyond her control. As they emerge and recede, her goals are changed.

This sentiment is commonly echoed amongst all of the athletes I interviewed. Most realize and embrace that winning the race, in the traditional sense of being the first person to cross a finish line, is not likely to happen and, therefore, is not prioritized. What is prioritized is a feeling of constant improvement, of maximizing what's possible on a given day. Such an endeavor is very difficult without the metrics that define and quantify this progress.

Now that the difficulty of existing in the feel network has been established and the importance of the metrics that wearables gather has started to be developed, we will move into the translation network, where the devices take center stage.

The Translation Network

When most discussions of wearables take place they are described in the language of the Translation network (Figure 4-3). "My Fitbit told me to do X" or "My Apple Watch tells me that I need to do Y." In these instances the device presents information about the body to the mind, essentially quantifying effort, or translating effort into a numerical representation. The device is granted an authority and a legitimacy that lends it an almost autocratic voice. In other words, the watch directs and we obey. At first glance, this sort of arrangement hearkens back to the subject/object relationship that we have fought so hard to distance ourselves from and echoes Heidegger's darker version of enframing. However, closer scrutiny reveals a different, less drastic reality.

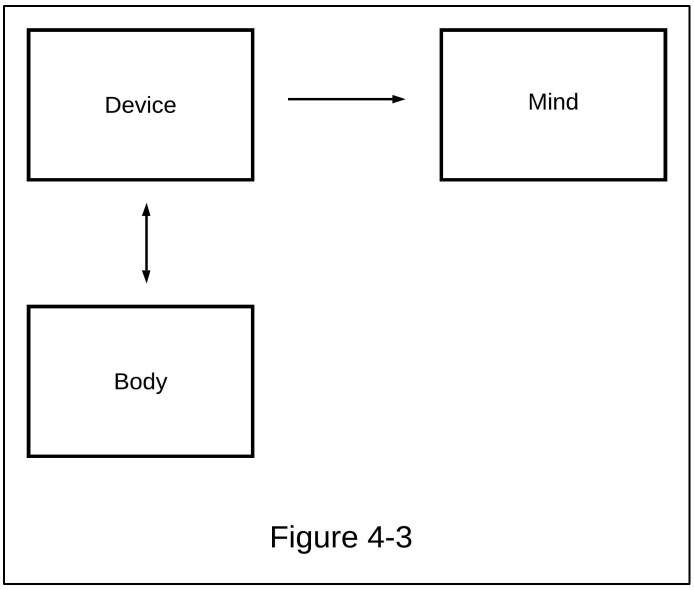

Figure 4-3

The Translation network positions the device as an intermediary, between the body and the mind. Whereas in the Feel model the body communicated sensations directly to the mind, in the Translation network the body sends those signals to the device. The device then, via data displayed on its screen or various forms of haptic or audio feedback, relays those sensations, quantified, to the mind. What separates this network from Feel most is that there is no connection between

the mind and the body. The mind is, literally, unable to access or interpret signals that the body is sending out. The device fills that space for the athlete.

While this state of affairs, losing touch with the physical sensations of the body, may seem dire or drastic, due to the incredibly demanding nature of triathlon and the stresses it places upon the body, it is not an entirely foreign state of affairs and happens at fairly predictable moments in racing. Additionally, as the duration of events lengthens, the mental acuity required to keep tabs on the body is lessened and the device becomes increasingly necessary for self-monitoring to take place. Here, the body sends information to the devices/s that is then quantified and relayed to the athlete. The athlete, then, receives the information from the device, makes a determination as to whether or not the data they are receiving is acceptable, and then attempts to make changes as necessary. These changes are then evaluated through the device, re-evaluated, etc.

Engaging in the Translation Network

Whereas it can be difficult to exist in the Feel Network and maximize physical potential, many of my participants indicated that they were quite comfortable existing in the Translation network (Figure 4-4). I attribute this to a number of possibilities, chief among which is the likelihood that the Translation network offloads a measure of responsibility to the devices. Virtually all participants indicated that when they trained, they did so with a schedule and that when they raced they did so with a plan. In the Translation network the device distills the often confusing and nuanced signals from the body into easily digestible numbers

that either line up with a pre-established agenda or don't, at which point an athlete simply follows the decision tree to a destination. The work of interpretation that is required in the Feel network is no longer in play when the actants are aligned as they are in the Translation network. Rather, the device gathers information and represents it and the mind need only run a comparison of those numbers against those from a previously determined schedule or plan.

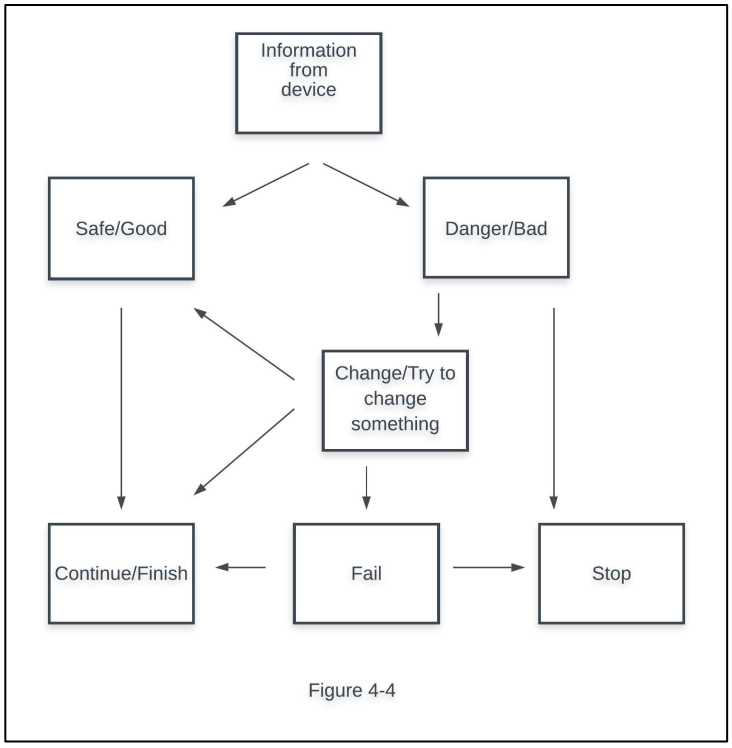

Figure 4-4

Perhaps the simplest explanation of the Translation network came from Mark who explained his reliance upon his watch when he swims laps in the pool, an activity that participants identified as profoundly monotonous when done for extended periods of time. "It's just easier to track instead of trying to count. Because I was wanting to know how far I was going, so I had to do a lot of mental math, but you know, and, and now I can just take a look. You know, I. Okay. I've gotten this far." By engaging with his watch in this way the activity monitoring his swimming performance and knowing when it was time to stop, upon completing a previously determined number of yards becomes a simple mechanical activity, rather than a

cognitive one. Mark swims until the watch "tells" him that he's reached his goal and he can then stop. The thought processes have been taken over by the device.

In addition to helping to assuage the boredom and repetition of lap swimming, participants indicated that they relied upon their devices to do the "thinking" for them during moments where they may have simply been too fatigued to process information and process on their own. One participant, Shannon, explains how she was very tired and found it difficult to keep track of where she was on the course towards the end of a Half Ironman.

> It was like you'd get in these sections and be like, okay, wait a second, now where am I? You know, because like that, that, uh, triathlete-head or whatever where you kind of like just lose everything and don't even know where you're at and you're just trying to get done.

In that moment she relied upon the device to tell her how much father she had to go and, just as importantly, that she would be able to continue and make it to the finish. "It kind of helped me know that I wasn't like I could see what my pace was and know that I wasn't pushing my pace too much." She, literally, relies upon the watch for the sensations that, under normal conditions, would come directly from the body. However, in a heightened state of fatigue, she is unable to access and evaluate where she stands in terms of physical ability or location.

While Shannon's situation sounds extreme, the Translation network does not require that one be on the edge of collapse. Rather, it's entirely possible to exist in this network as a consequence of foresight and planning. Lucy says:

> I think I'm a little bit more regimented with it, with the technology, because I can set a run walk interval and regardless of if I can keep going, I'm like, it's Pavlovian now. You're like beep, beep, stop, walk, beep, beep, start running. And, like, I mean, that's really what happened in my race. Like, it was set to a specific thing and because I knew it was going to be hot, I think I'd set it to like a one-minute run, a 45 second walk.

This example clearly outlines how the Translation network can work hand in hand with a previously established plan. Understanding that Translation can and often does work under preplanned circumstances is important because it prevents us from inadvertently identifying Translation as a harbinger of crisis or as a sign that an athlete has reached the end of their cognitive limits. Rather, Translation is the state of affairs that results when an athlete is unable to access or process sensations from the body. In this instance these inputs would not be available to the athlete without the device.

One moment in racing triathlon that really challenges the ability to accurately monitor the body and evaluate physical sensations that it produces is referred to as transition 2 (T2), the place where an athlete dismounts from their bike and begins the run portion of the race. Most of my participants raced the Half Ironman distance which means at this point in the race they have just completed a 56-mile bike ride, often over 3 hours of biking, and are about to go run 13.1 miles with virtually no pause between the two activities. The transition between these two requires a shift in muscle usage from being primarily driven by the quadriceps to the hamstrings in

a state of considerable fatigue. The result is often an inability to gauge the body's progress for a period of time.

> Steve: My biggest difficulty and my coach has always told me is, and this is where the instrumentation helps, the watch helps, is a get your feet under you for the first whatever timeframe it is and then look into yourself and we measure, we keep a measurement and what each of those should look like. So I'm able to push myself a little harder out of transition because of the watch and then set a pace, a comfortable pace after I get my feet under me.
>
> Interviewer: Can you sort of walk me through the, the interactions, uh, coming out of transition? How often are you looking at your watch? How much of this is feel? How heavily reliant and for how long are you in that space?
>
> Steve: Yeah, that's a great question. I look at it more frequently than most people. I would say, at first, it's probably every going to be really round, say 10, 15 yards, just to be sure I'm not going too hard or I'm going too slow. I'm trying to keep in those zones[19]. Um, and then as I go further into the race less and less frequently.

There is a lot to unpack in this exchange. First, it's important to note that Steve talks about "getting his feet underneath him." He's talking about establishing a sense of rhythm to his running, something that would be routine under normal circumstances. However, in this moment he is forced to rely upon his watch because any sense of running rhythm has been rendered inaccessible for a time

[19] Steve is talking about heart rate zones. Depending upon the model used there are typically either 5 or 7, each denoting a range that is tied to a particular level of physical intensity.

because of the impact of the bike leg on his body. When he talks about "looking into himself" he immediately follows it by nothing that this "looking" is pre-measured and quantified. It is something that he has determined ahead of time and, therefore, can look for in the watch display rather than obtaining via traditional sensations of feel. Additionally, it's interesting to note that his sense of feel is diminished to the point that he checks the watch as often as he does, indicating that any sense of feel is, in his eyes, unreliable. And, finally, what this example shows clearly is the way that Translation can be combined with a plan. The pace numbers that he is looking for measure one aspect of his physical performance. However, these are double checked by where he falls in terms of heart rate as well. In this way, Steve's performance coming out of T2 is entirely quantified and translated to him numerically. He is engaging with the GPS sensor in the watch rather than his physical senses to tell him how far and how fast he's going and he's comparing those numbers against the heart rate numbers that his chest strap is providing him to measure effort a second way. As long as these two numbers fall within acceptable ranges and ratios, Steve will continue to progress. And, assuming that the run goes according to his plan he will gradually ease away from such a heavy reliance upon the devices and move into the third and final network, Cooperation.

Cooperation Network

If I was going to attempt to organize the three networks that I've identified in this study, I would place Feel and Translation beneath the Cooperation network (Figure 4-5). This is not to say that one must necessarily strive to engage in the

Cooperation network, or that existing in Feel or Translation is somehow inferior. There is no inherent linkage among the three that necessitates such a conclusion. Rather, I situate Cooperation above Feel and Translation because it is the most complex. Similarly, both the body and the device play active roles in both sending and receiving information that is impactful regarding performance. In this way, the Cooperation network functions as a sort of an evolution of the other Feel and Translation. While Cooperation does borrow from the other two in that they share the same actants, the processes of the Cooperation network are unique in that all actants must negotiate multiple streams of input and balance among them in the decision making process.

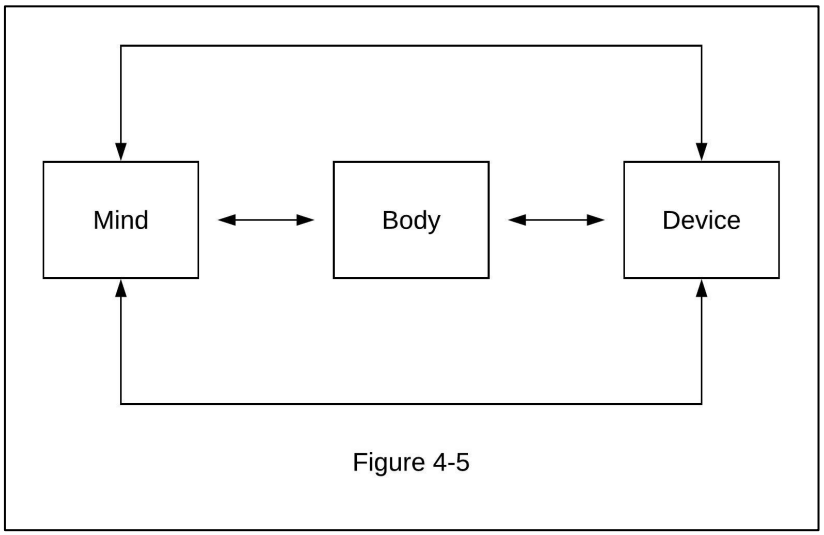

Figure 4-5

In the Cooperation network, all three actants reciprocally (and assertively) communicate with each other. The body engages with both the device (the device records heart rate, pace, distance, etc.) and the mind (through physical sensations: pain, thirst, etc.). The mind sends input to both the body (in the form of neurally transmitted signals to go faster/slower) and the device (in the form manipulation – choosing a dataset/screen). And, finally, the device engages the body (through

haptic and audible alerts) and the mind, (through the biometric data that is represented on the screen).

The Cooperation network utilizes a significantly more complicated decision tree than the other two networks (Figure 4-6). However, as its position at the top of my hypothetical pyramid implies, the alignment or engagement of certain actants requires/creates a shift out of the Cooperation network into one of the others. As a result of the high potential for movement it can be argued that the Cooperation network is the least durable (most difficult to maintain) of the three as there are more opportunities for the engagement among actants to alter goals, shift alignments, and change the nature of the network. The volatility in the Cooperation network is not to argue for an inherent stability in the other two networks. Rather, my interviews have indicated that when an athlete is in the Cooperation network

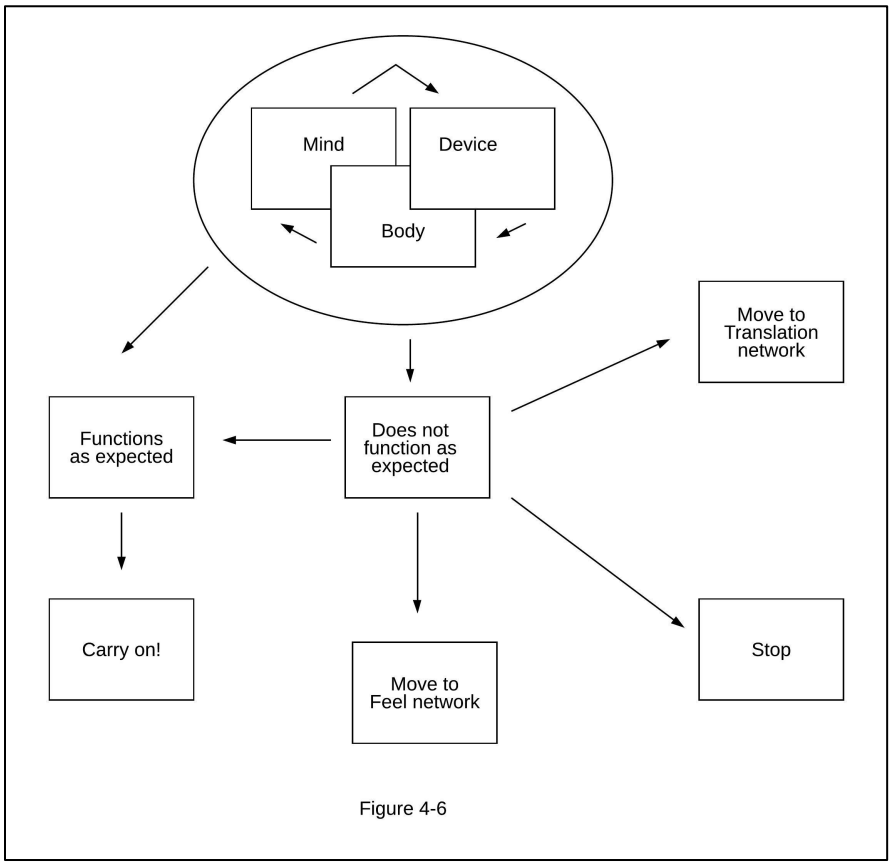

Figure 4-6

they are likely to stay there for a short time only as the myriad other actants that we have not accounted for in this study (weather, course conditions, other competitors, etc.) are likely to alter the somewhat precarious balancing act that is the Cooperation network.

Time spent in the Cooperation network, for many athletes, is akin to time spent between Feel and Translation. One way of looking at the movement of actants and the formation of networks would be to argue that Cooperation is ephemeral, existing merely as a bridge (back to) one of the others. However, it is equally plausible that Cooperation is, in fact the most often inhabited network, despite its lack of durability, in that athletes continually seek it and find their way back to it. After discussing how the network functions, we will spend some time discussing the manners in which movement among the three networks takes place.

Engaging in the Cooperation network

Active engagement in the Cooperation network requires an elevated understanding of both the Body and the device. However, in addition to recognizing how each actant functions, it is also important that an athlete understands how they function together – how they interact. It is not enough to know the body, know the device, and to have a plan. The three must be in sync, productively engaged in order for a durable, functioning network. By way of example, Kara, one of the participants in this study explained how she manages input from her device while incorporating knowledge of how her body works. "I feel fine at 165 [heart rate], you know, obviously I have a different scale, you know, and I did go and have some VO2 Max

testing done and get all my different levels. So, you know, I knew, […] that that was an okay heart rate for me to run at." An athlete that was operating within the limitations of the Translation network that had not developed an evolved sense of their body would likely see a heart rate of 165 and either drastically lower the intensity or stop all together. That number, for most, exceeds any range that would be safe for prolonged endurance training. However, Kara has developed a very acute sense of what her body is capable of and understands that, as long as she feels ok, the decision to override or ignore the device feedback is a sound one. This is a clear instance of the two actants, body and device, both providing input to a mind that understands and can value each source and then make a productive decision for action.

The processes involved in the determination of which actant will come to the fore –the device, the body, or the mind, is one that is achieved only through developing a nuanced understanding of how all three work, on their own and in conjunction with the others. Kara is the most accomplished athlete that I spoke with, having found success while competing at the very highest levels of triathlon.

> I've been doing Triathlons for probably about 15 years. I just did my 10th Ironman. Um, now at this point I usually am on the podium most of the time. If it's a half, often I'll win my race. So, you know, I just, I've just gotten better through the years and, and uh, you know, the competition has kind of fallen by the wayside, you know, as I get into the older age groups, so, you know.

Anyway, so yeah, I've been to Kona[20] twice, I've done the half champs[21] many times. Um, so I'm still an amateur, but you know, I definitely am seasoned.[22]

The "seasoning" that she speaks of is a direct reference, I feel, to the balance among mind, body, and device in terms of getting her body to perform to its potential, a feat that requires, not just the alignment of actants into the Cooperation network, but also an ability to maintain this arrangement, to create a durable network. Unlike many of the participants who are newer, or less engaged in the sport she is able to sustain this network for longer periods of time.

In discussing how that line between performing by Feel and by performing according to device metrics, Kara mentioned what a hybrid metric that is often used in endurance sports: rate of perceived exertion, (RPE). When using RPE an athlete will assess how "hard" an effort feels and assign it a number between 1-10. In this way, the athlete begins to learn to quantify his or her own experiences. This, of course, is done without any quantified input from a device that actually measures physiological stresses. By refining their sense of feel and quantifying the sensation an athlete learns to think in a manner that parallels current wearable device outputs and provides a more granular understanding and point of engagement with and aspect of performance that is, outside of this perspective, limited to the language of the Feel network. In this way, an athlete is able to utilize a language that effectively

[20] The world championship Ironman distance race, held in Kona, Hawaii annually. This is the pinnacle of triathlon racing.

[21] This is the 70.3, or Half Ironman world championships, also held annually.

[22] Shortly after this interview, Kara won her age group in an Ironman race, sending her to Kona for a third time.

describes both body and device, making productive, agentive comparisons between the two possible. Kara said:

> Um, well I think feel is perceived exertion feel. I think it's, um, probably one of your best metrics, but you know, there's a range of, I feel good here and this is too fast and this too slow. But there it's a range. And so it within that range, they're different paces you can go that are faster or slower, but you're still going to feel okay. And so it's a combination of looking at what pace you're going and your perceived exertion and seeing if you can push it a little faster. You could probably, you know, if you feel like you could go faster based on your time and your knowledge of what you can usually do. So I do find that it's really useful to use the two together and the other, uh, the other times are when you're trying to push a pace and you say, well, I'm going to see if I can do this today, which is a little faster than I've been doing. And your perceived exertion tells you, no, I'm not ready to do that yet. So then you back off and you try again next week.

It's worth noting that Kara's description of the two different actants, body and device, are discussed in a language that is functional to both. This enables her to more effectively engage with each, body and device, simultaneously and make decisions that accounts equally for both sources of input. When an athlete is able to function in the Cooperation network in this way, when they have developed a unique calculus for decision making that values each actant individually and then makes decision based on a holistic evaluation of their inputs, the network achieves a measure of durability and as a result it appears from the outside to be black boxed.

In the next section I will discuss how and why movement from one network to another takes place.

Following the Actors: Movement Among the Networks

Despite the fact that this analysis has presented an extremely slimmed down accounting of the actants in a network by opting to focus only on mind, body, device, there are, to be sure, countless other actants at play in each of the networks that have been detailed here. Thus far, to keep things simple it's been necessary to focus on the relationship among these three. However, in a context such as triathlon where there are several moving parts, even in its simplest presentations, when we begin to talk about shifting networks it is necessary even if only briefly to introduce other actants that will come to the forefront of the various networks to reframe the organizations and enable new possibilities

While positioning the actants according to their relationships in the Cooperation network highlights their reciprocal interactions and enables us to more clearly see the influence of one on the other, introducing others, such as weather and course topography (both, again black boxes of yet still more actants) makes the process of shifting networks and emergent goals easier to identify. As Kara continues her explanation of her engagements and decision making process in the Cooperation network we see that when the relationships are changed so, too, are the actions that follow. Moving from one alignment of actants to another effectively alters the collective, revealing new goals.

> Yeah, I mean, um, sometimes you have to modify your goals, I mean, I usually try to go as hard as I can for the given situation, you know, and stay in the range of what kind of race it is, but I, yeah, every race I go to I try to do my best, but sometimes you have to alter your goals based on how you feel. Um, you just sometimes never know how you're going to feel race morning and I would say over time with more experience that happens less often. Um usually, I feel pretty good now, most of the time when I get up for race, but, but you know, there's some days you just don't have it and you know, you just do the best you can with what you have from any given day. And so sometimes. Yeah. So I'll just, you know, if I find that I am just having a really hard time running and I'm looking and I'm running, you know, I just, you know, 10 minute miles, uh, I'll just stop looking at the watch and just do the best I can.

In this explanation we see that when "how you feel" changes – how the body is able to assert itself, the nature of the network shifts (it doesn't matter how, really) and the goal is forced to change. Each arrangement of actants, what Kara refers to as "a given situation" has its own product. The quote above shows us how movement from the Cooperation network to the Feel network is possible as the result of a watch that consistently delivers bad news. Conversely, we can see in the following response from Simon that the prolonged influence of any number of actants may result in a situation that moves into the Translation network as an athlete's ability to reliably engage their inner calculus for Cooperation deteriorates and reliance upon the device as the primary input source becomes necessary.

> I definitely think the heat and the exertion and all that stuff. I think it start to mess with you a bit, you can kind of go off into La La land for a little while and you can either go too hard or too soft and not eat and not drink which are really critical for a long race like that. And so I think by having just kind of that focused timer every 15 minutes those things yelling at you like drink. Eat. Check your power. Get dialed in here. I think that really sustain the effort throughout the race.

The move into the Translation network because of the withdrawal of actants in the Cooperation network enables Simon to "get dialed in" and refocus his efforts.

I would like to note that movement from one of the networks to another is never a result of human intentionality. Rather, it is the result of new socializations among the actors in the network, changing the way that it functions. The result of these changes, which are external to the desires of human actors (and always a slight surprise), is participation in a reconfigured network that functions differently.

Final thoughts

Over the course of the interviews with my survey participants it became evident that athletes engage with wearable technologies in idiosyncratic ways. However, despite the highly personal nature of engagements, it also became clear that there are patterns to the use scenarios that I have identified here as the three networks, Feel, Translation, and Cooperation. Each, certainly, is a simplified rendering of the actants involved and their interactions with each other; a total accounting is impossible. I have not tried to be prescriptive and make any

statements that could be misinterpreted to imply that any one collective or network produces a particular effect. Rather, what I have found (and hope that I have made clear) is that any of the networks opens possibilities for a certain set of possibilities at the same time that it renders others impossible. The nature of what is enabled and what is foreclosed would be revealed in greater detail with a more thorough accounting for involved actants. Given the Russian doll nature of the black boxes that comprise any single actant, though, we can see how chasing the series of connections in search of a final accounting becomes Sisyphean. What this analysis does show us is that the interaction of the actants and their place within a given network does influence what is possible. And, understanding this, we have seen how triathletes of varying levels of ability are able to intentionally orient themselves in relation to their technologies and goals to allow certain results to be possible.

Chapter 5. Looking Back and Looking Forward: Reflections and Future Implications

Overview/Summary

I contacted a local triathlon team with about 300 members and issued a brief, five question survey that asked about the use of wearable technologies while training and racing. After the survey had been available for two weeks, I conducted interviews with 14 randomly selected participants that had completed the survey and indicated that they would be willing to talk further with me. Each of them reported a unique relationship with their technologies in regard to both preference (which devices to use and when) and use (which metrics to track and how/if they would be displayed). Despite the idiosyncratic nature of the relationship between human and nonhuman actants, a consistent roster of actants became evident in each of the networks. Regardless of the devices used and the data that were tracked, the networks that were formed were similarly composed. The argument that there are consistent patterns in network formation seems, at first, to fly in the face of Latour's (2005) argument that "there exist hierarchies, asymmetries, and inequalities; that the social world is just as differentiated a landscape as a rugged and mountainous terrain" (p. 63). However, if we step back far enough we realize that, while the individual contours of any single mountainous terrain are going to be unique, all mountains still display clear similarities. As with the mountains, the manner in which actants were arranged relative to each other in the networks that formed with wearable technologies followed similar orientations. That is to say, while there

are countless nonhuman actants involved in the networks, the dominant actors in this study remained the same.[23] The durability of networks also seemed to remain more or less consistent, despite the fact that they are temporary. And, finally, it became clear that these networks are not composed, utilized, or adjusted at the behest of human intentionality. Latour (2005) states that action, the product of a network "is not done under the full control of consciousness; action should rather be felt as a node, a knot, and a conglomerate of many surprising sets of agencies that have to be slowly disentangled" (p. 44). It is important to note, here, that Latour qualifies action as co-produced and, perhaps more importantly, as a surprise – something clearly outside intentionality.

As networks are based on a particular constellation of actant socializations, namely, the coming together and ordering of actants in a given circumstance, their durability is limited to the stability of a given context. In this way, triathlon provided a productive context for the study of networks as, for a variety of reasons, context continually shifts. The fact that there are three distinct disciplines in each race forces contextual adjustment. Additionally, athletic performance in general and endurance sports specifically, lends itself naturally to shifting contexts as the body and mind both fatigue and respond to the punishment of exertion over time. Latour (2005) reminds us, "no tie can be said to be durable and made of social stuff" (p. 66).

[23] Perhaps it's stretching the mountain analogy a little thin, but I would argue that, with different technologies and different use applications, the similarities would end. In other words, I would not expect the patterns and Configurations that arise in networks with wearable technologies in a medical setting to necessarily mirror those in triathlon. However, within triathlon, the mountains all appeared similar in temperament.

As an athlete's experience of themselves and their performance changed, often, so too did the configuration of the network and, thus, the nature of agency.

Reflections

The central idea behind this dissertation project is that many of the things that we interact with in our day-to-day lives are more than mere tools to be "used" by independent, self-directed human agents. Rather these "things" are active, assertive agents. The need to explore ways of accounting for the impacts of the engagements between human and nonhuman actants becomes increasingly important as technologies continue to evolve and become smarter. The idea that things shape and define our experiences of the world as merely passive objects is an anachronistic view. Barnett and Boyle (2016) argue that

> Things are more than what they mean or do for us. They are also vibrant actors, enacting effects that exceed (and are sometimes in direct conflict with) human agency and intentionality. Understanding them as rhetorical, however, requires more than a leap of imagination; it requires a shift in some of rhetoric's most entrenched critical, methodological, and theoretical orientations. (p. xi)

As Barnett and Boyle argue, a shift in our orientation to the rhetorical potential of objects is in order if we are to understand their potential to shape our experiences of the world around us. In many ways, this shift away from traditional rhetoric has been taking place for some time. The feminist rhetorical scholarship of Julia Kristeva (1988), Judith Butler (1990), and Donna Haraway (1991) paved the

way for the decentering of the human subject in various ways. More recently, the scholarly endorsement of new materialism has focused attention on the roles that objects have in shaping human experiences of the outside world. Scholars such as Bruno Latour (1999, 2005), Diana Coole and Samantha Frost (2010, 2016), Jane Bennett (2010), and Karen Barad (2007) have engaged questions of the ways that our things act upon us, intentionally moving the human subject away from the center to better understand the impacts of nonhuman actants.

Our interactions with things are complex affairs that are not always synchronized or harmonious in ways that privilege the human actor or her intentions. To more fully appreciate the complexity of these interactions we need to frame them as rhetorical moments. Doing this requires shifting from traditional rhetorical orientations to new perspectives that are more inclusive of nonhuman agents. Diane Davis and Michelle Balif (2014) state "traditionally rhetoric names a specifically human art or science, requiring at least one discrete human subject at the center of its operations. Even what the discipline of communication studies calls "extrapersonal communication" […] presumes first of all a preexisting human subject" (p. 348). To make space for nonhuman actants, to enable and understand the scope and potential of nonhuman agency, requires that we decenter the human subject and make room for other actants. In doing so, though, we must be careful to not marginalize the human role of involvement. It is not, and never has been the goal of any object-oriented ontology to do away with the human actor. Rather, we must question the role of human intentionality as the sole or driving source of

outcomes and allow that there are other forces at work that are able to assert themselves in meaningful ways.

As a means of framing and understanding agency as a co-production among human and nonhuman actants, this project utilizes new materialism and actor network theory as primary lenses for exploring the interactions between triathletes and wearable technologies. This orientation enables us to more fully understand the decision-making processes that occur during athletic performance. A basic underlying premise of the project is that the subject/object relationship that has traditionally been used as the de facto starting point for investigations concerning the relationship between human and nonhuman actors is limiting and prevents a more robust understanding of what really happens when we engage with the nonhuman things around us. Rather than merely accepting human intentionality as the driver of agency, this study posits that our relationships with things are more complicated; they can no longer reasonably be viewed as inert, inactive, or ineffective in their relations with human actors. Instead of viewing technologies simply as tools, we achieve more by considering the decision-making process as a mutual, co-produced endeavor that is informed by agency from nonhuman, as well as human actants. One of my participants, Kara, explained the manner in which the shifting of prioritization between the device and body as driver works for her:

> There are times when you will not physically feel fantastic, but you will let the device dictate, no, this is the number I'm trying to hit. And sometimes that pays off and you can, you can work through and that feels good again. But then at other times I'm going to try and hit this pace. You know, that's an

> easy number to say, or wattage or whatever the case may be. Um, and then the body just reinforces, no, I really can't do this today. And then at that point you back off and re assess.

Kara understands that her body may well be capable of more effort than it wants to produce. However, the devices she uses provide objective metric representations of her efforts and indicate to her that she is, in a given moment, underperforming, and urges her to push harder. This example clearly displays the shift between human and non-human actants in decision-making that directly translates to a particular course of action during physical exertion.

In addition to a more robust understanding of the manner in which human actants respond to nonhuman agency, the potential for more effective collaboration with our nonhuman counterparts offers considerable benefits. With this perspective as a backdrop, my research addresses the two primary questions laid out in previous chapters: How do age-group triathletes engage with wearable technologies and what are the impacts of those technologies on their performance and decision making as they relate to triathlon? As my research progressed, the underlying architectures of the interactions between human and nonhuman actants became clear, which made it increasingly evident that our things are so much more than mere objects. The implications of our interactions are more than just the manifestation of a singular human intention. Often, they are the results of multiple actors. One of the participants in this study, Steve, makes this point clear when he discusses his reliance on wearable technologies. For him, rather than simply being a

conduit of information, the device becomes an active participant in the project of completing a workout.

> I do the workouts. I mean, I may not do them well and there's a school of thought that if you're not doing them well, quit, come back tomorrow. I don't do that. I just scale it. And so I get some benefit or at least maintain, and I scaled to the point where I'm not going to be injured. And these devices do help me significantly with that with the metrics that I use on the device.

Steve's statement makes the various agencies among actors clear. Implicit in his statement is that his actions (and justifications for them) exist at the confluence of inputs from: a coach, a plan, his own perception of his physical state, an assessment of the likelihood of injury, and input from his devices. There are, should we decide to dig deeper, inputs from countless other actants. Ultimately, as this brief passage makes clear, human intentionality is one of many inputs in the determination of decision-making.

Implications and Future Work

The idea that non-human actants can assert themselves in ways that challenge human subjectivity is problematic for traditional conceptions of rhetoric that privilege language and human intentionality as the sole sources of agency. Bennett, (2010) states,

> For some time political theory has acknowledged that materiality matters. But materiality most often refers to human social structures or to the human meanings "embodied" in them and other objects. Because politics is itself often

construed as an exclusively human domain, what registers on it is a set of material constraints on or a context for human action (p. xvi).

We have been conditioned to see material things, non-human actants, as tools whose materiality may be impactful, but is so at the behest of human intentionality rather than in and of their own relationships to the world.

In a world that is increasingly populated by "smart" devices that are both dynamic and able to act independent of human intentionality, contemporary approaches to rhetoric require a shift in perspective. Barnett and Boyle (2016) argue that "Understanding things as active agents rather than passive instruments or backdrops for human activity requires different orientations on rhetoric, orientations inclusive of human beings, language, and epistemology, but expansive enough to speculate about things ontologically" (p. 3). New materialism serves well as an alternative to traditional, subject-oriented rhetorics as it does not attempt to remove human actors or intention from the rhetorical puzzle. Rather, it seeks to make room for other actants to enter the fray alongside human actors, complicating our understandings of the mechanisms that produce agency and, ultimately, leave us with a deeper understanding of the interactions that produce action. This is clearly a drastic shift away from traditional rhetorics that privilege the human subject and focus on epistemological concerns, rather than ontological ones.

> In epistemic paradigms, the human subject occupies a privileged and central position in the rhetorical scheme of things. While epistemic frameworks allow for inquiry into nonhuman actors (objects, places, media, technology), such inquiry invariably begins and ends in the same place. From the

> epistemic point of view, the world matters, but only insofar as it matters for us. (Barnett and Boyle, p.3)

This project investigated the interplay between amateur triathletes and wearable technology on the decision-making process. I argued that decisions were made via a coordinated interaction involving both animate and inanimate actants whereby notions of agency are distributed across the network, dependent upon context. By allowing that things have the potential for agency when socialized in networks, rather than merely being inert stuff, new materialism allows this project to step outside of the dominant Cartesian subject/object orientation that privileges human intentionality as the sole source of agency. As a result, new materialism provides a perspective from which we can better understand the multiple mechanisms in play regarding decision-making during athletic performance. Additionally, this perspective allows us to see more clearly how, when context places human actors at a disadvantage (mental acuity may be diminished as it is during prolonged endurance sports), other actants come to the fore of the network. There are multiple ways in which disparate actants engage, come together and recede from view. In all cases, the process of acting is achieved with input from competing assertions of multiple and shifting actants. This project has attempted to broaden conceptions of agency and make space for a more inclusive explication of agency, decentering the athlete as the sole determinant of action in athletic performance. Barnett and Boyle (2016) argue that "humans and nonhumans are co-constitutive and co-emerging, all involved together in composing our shared worlds" (p. 8). This argument was borne out across all of the research in this

project, regardless of the network formation and of the dominant actants in a network. As Latour (2005) reminds us, "we are never alone in carrying out a course of action" (p. 44). The networks that formed around the use of wearable technologies for triathletes in this study bore out that conclusion.

New materialism articulates the significance of our engagement with the world around us in ways that traditional rhetorical approaches could not. Certainly, it is not the only means of discussing the interactions of human and nonhuman actants, but, by shifting from an epistemological to ontological focus, new materialism reframes the basic premise of what constitutes an agentive actant and reconfigures the preconditions for agency. This move allows us to complicate our understandings of rhetorical engagements, of the ways in which we relate to our environments and the manner in which we interact with the objects around us. These complications allow us to engage with the world in novel ways, to search for (and define), what Scot Barnett (2010) calls our missing masses. In Reviewing Graham's Tool-Being: Heidegger and the Metaphysics of Objects (Open Court, 2002), he argues that these are "not separate or merely additional constituents in rhetorical situations, these materialities and their intertwinings constitute our reality—are part of the very is-ness of that reality—in ways that fundamentally shape our very senses of what writing means and how we practice and teach writing in the world today" (np). New materialism, along with other object oriented rhetorics, provides perspectives that were, with traditional rhetoric, previously unavailable as the grammar of the rhetorical configurations simply would not allow for them.

New materialism, actor network theory, and other object-oriented rhetorics enable the creation of models that are impossible with traditional rhetorical approaches. By way of example, Latour's conception of the black box allows us passage through (or at least access to) questions that are otherwise inaccessible with traditional rhetorical approaches for the simple fact that they do not have a language producing human subject at the center. Rather, this model elegantly reveals one manner in which nonhuman actants engage with human actors, ushering humans to the periphery, rather than the center. In these networks, framed by necessity in moments of technological glitch, it is the nonhuman actants in the network hailing their human counterparts into a network changed by circumstance. We see clearly that agency need not be solely the domain of human actors and intentionality. By allowing spaces for nonhuman actants to actively behave as agentive participants in networks, new materialism and actor network theory provide us a previously inaccessible language and, therefore, insight into the interactions of nonhuman actants as active participants in rhetorical situations. By extension, these same models allow us to engage a host of new actants and appreciate how they engage with their human counterparts.

A second, equally important contribution to rhetorical studies that a new materialist lens offers is the perpetual reducibility of any rhetorical situation. The black boxing that Latour describes arises out of moments created by a technical glitch. When things break, or cease to function as anticipated, we notice them and subject them to scrutiny in ways not necessary when things function as expected. These moments provide opportunities where we clearly see the agency of the

nonhuman actant; first by their ability to hail human actants and, second, by placing their (unexpected) actions on clear display. These boxes are perpetually reducible as necessary. Each "thing" is reducible to other things. The concept of the black box means that we can always identify socializations as rhetorical moments that can be redefined by the sum of its parts. A networks principle actants can be (re)framed, (re)defined, and engaged in more specific, targeted ways. The plasticity of new materialism, along with other object-oriented rhetorics, provides "new theoretical orientations that, though recognizably rhetorical, enable us to begin our inquiries from different places, with different attunements and different assumptions about what it means to be – to be rhetorically -- in the world (Barnett and Boyle, 2016, p. 2). Identifying and then opening Latour's black boxes enables us to continually (re)frame and reduce what appear to be whole systems into smaller pieces that are more easily managed or provide different points of engagement. Rather than seeing singular wholes, we have the option of identifying and addressing smaller pieces of the whole that, through other lenses either don't exist or aren't as readily accessible.

New materialism allows us to enact a black box approach, even when things are working as expected. Actor network theory provides an approach for Latour to unveil nonhuman agency. He argues that technological glitches, through their disruptions to human intentionality, served as moments where the agency of nonhuman actants becomes clear. I argue that by allowing agency to nonhuman actants we no longer need glitches to engage with their potential. Rather, by placing them on a horizontal orientation with human actors, by allowing them the same potential to influence networks, we open the black boxes for scrutiny at all times. As

a result, rather than having to deal with larger "whole" systems, we are able to more pointedly engage with the workings of carefully selected systems. New materialism allows us to engage more deliberately chosen investigations. We are no longer constrained to "whole" systems, as any particular aspect of agency can be viewed as the product of its parts. Additionally, we are no longer limited to moments of breakdown for starting points. In other words, granting agency to non-human actors allows for a broader, more productive engagement.

There are consequences, though. Most specifically, we are now faced with the prospect of having to account for a dramatically more complex cartography of systems. Rather than looking at traditional cause and effect relations that employ a simple, clearly defined (and uniformly agreed upon) subject and its accompanying object, new materialism produces systems populated by actants that accompany both roles simultaneously. As such, while they become horizontal, the grammars, the forms and structures of our networks, are no longer linear or static.

Limitations

There are, certainly, limitations to the utility of new materialism, and I do not want to give the impression that I see it as a panacea for the shortcomings of other theoretical approaches, or am attempting to apply it as such. While new materialism enables the ability to continually drill down in order to more specifically understand myriad actants engaged in any network and to redefine social engagements among them, it also carries with it the potential to problematizes some of what it proposes to enable. Most notably, new materialism

presents a methodological challenge. We want to avoid the fate of Sisyphus, continually pushing his boulder up the mountain. Part and parcel with new materialism is that we must limit our investigation and, as such, we must always be willing to draw lines that exclude a number of actants. In this study, that has meant not accounting for external factors in the athlete's performance. Certainly, wind, terrain, nutrition, etc. all play an active role in performance. The list is always going to be endless. In this way, picking up new materialism as a lens will always require that our study be incomplete from certain perspectives. We will never be able to conduct an exhaustive study. There is always one more rabbit hole begetting another. Faced with this reality, new materialist analyses must set conscious and purposeful limits on their extension.

My project involved a series of research questions that are largely apolitical and very friendly to the use of new materialism[24]. They do not, by their very nature, invoke the shortcomings implicit in the approach. As much as the affordances of new materialism make for a compelling lens for rhetorical investigation, as an approach it is not without its limitations. And, while there are many, I want to focus primarily on one that reaches out and forms the potential basis for many others. I will leave the articulation of a complete catalogue of the shortcomings and limitations of new materialism for someone else's project.

In its quest to decenter the human subject and provide an agnostic platform for all socialized actors, new materialism runs the very real risk of depoliticizing its

[24] For example, I did not attempt to address issues of data privacy or any of the implications (ethical or otherwise) of these data being made available to third parties. The implications that arise from these circumstances are highly political and have been addressed elsewhere.

projects and inhibiting the ability to address some of the inadequacies of the human condition. Christopher Breau (2016) states

> For contemporary materialist discourse to reach its fullest potential, it needs to embrace the political more fully. This means not only addressing issues around economics and ecology, but also issues around class, race, gender and sexuality (as they both intersect with and exceed the economic and ecological). We need to think about the non-human, but we can't lose our focus on the human as well. To do so, would mean that we run the danger of becoming complicit with depoliticizing dynamics in the academy as it has been restructured by neoliberalism. (p.22)

Much of the literature that deals with new materialism turns its focus to the roles that the material things play in our worlds. While they go to great lengths to articulate and sketch the ecological compositions, they often fail to frame these contexts, actions, and implications around human conditions. As a result, new materialism is a tool that is very poorly situated for work that seeks to emancipate, or dislodge entrenched ideologies of subjugation.

Compounding the problem of new materialism's emphasis on decentering the human subject and language is that, without a subject, an object becomes an impossibility. Without language, we lose our ability to name that which we seek to address in the first place. As such, rather than enabling the disenfranchised to occupy a central, articulated position, new materialism frames a rhetorical situation by enabling insight in terms of the how socialized actants engage. It provides a lens through which we can see these engagements but, much to its lack, new materialism

provides no mechanism to give name to marginalized actors or to actively call actants back to the front of a network when they recede. In many ways, due to its insistence on inclusivity, we lose the trees for the forest. We can neither attempt to emancipate the oppressed or call to justice those that would push certain actors to places of less agency that would be just. In this way, while new materialism certainly allows for increased levels of agency and inclusivity among socialized actors, it does so by limiting our ability to engage them directly as either individuals or outside of a context. Graham (2015) notes

> For some, this call for materiality is a call to investigate the economic and institutional forces that surround discourse (Haraway, 1997, 1998; Herndl, 2002; Kinsella, 2005; Latour, 1993, 1999; Scott, 2003; to name just a few). For others, however, the argument for materiality focuses on the objects of reality and might be more aptly be described as an argument for a reincorporation of ontology (Bennett, 2010a, 2010b; Jack, 2010; Mol, 1999, 2002; Pickering, 2010; Graham, 2009; Harman, 2009; Herndl, 2002; Lynch, 2009; Marback, 2008; Rickert, 2013). (p.14)

Either way, without clearly defined subjects and objects, new materialism runs the risk of marginalizing language itself. Its free-flowing, dynamic nature leaves us without a stable grammar to anchor socialized actors in place. As a result, it becomes impossible to address any actors individually. Latour is explicit about this when he argued that power was located in the network rather than the individual actor.

Graham, (2015), makes the limitations of language evident in addressing a singular actor that exists dynamically. He states simply "Pain defies modernist categorization." (p.3). Despite the fact that we use the same word to describe the condition, there is a clear distinction to be made between the pain of a broken heart and the pain of a broken bone. Both instances produce acute physical manifestations and yet are very much independent of each other. However, this same actor (pain), socialized with different actors, and as the result of different contexts, elides a precise, unique, linguistic signifier to differentiate it. So, in this way, with the application of new materialism as an investigative lens, we gain inclusivity but at the cost of precision. Graham (2015) continues,

> The arguments of new materialisms can be enacted with a variety of different overlapping foci – but these are foci of the same arguments made by the same scholars. There is no physical-material camp and no socioeconomic material camp. When it comes to new materialisms it's a both/and rather than an either/or approach." (p. 14)

The application of new materialism means that we accept all actors as potentially impactful once they are socialized in a network. It also means that the socialization changes them but does not provide a changed nomenclature with which to engage them. Latour's black box goes some way in anticipating and mitigating the implications of this issue. However, while those black boxes have rich potential as sites of inquiry, under certain circumstances, those philological shortcomings could be potentially problematic.

Conclusions

As this project has attempted to make evident, employing new materialism as a means of articulating the relationships between human and nonhuman actants requires reconfiguring long held assumptions about intentionality, subjectivity, objectivity and agency. It requires a willingness to accept the premise that the human actor is not the sole determinant of action. New materialism requires us to accept that agency, rather than being the product of human will and intentionality, is a coproduced product derived from the interaction of countless agentive non-human actants. This can be problematic as we have been long conditioned to see reason (even faulty reason) as the guiding principle behind action. As this project has shown, there are times when nonhuman actants act in ways that are simply not predictable. Unforeseen technological glitches are not guided by or defined by rational intents. In these moments we can, of course, dig deeper into increasingly more narrowly defined black boxes like so many Russian dolls, looking for answers.

I do not see new materialism as a universally applicable or preferable lens. There are, certainly, scenarios where other lenses may prove to be more effective or productive. Such scenarios are certainly shaped by the confluence of researcher intent, predilection, and any number of other physical, ideological, or philosophical constraints. As such I have tried my best to avoid being inflexible or dogmatic. It is not my intent to frame new materialism as more than it is: a useful tool in the researcher's toolbox. Certainly, the toolbox is vast, and as researchers, we would be remiss if we were to focus on one tool at the cost of others at our disposal.

As the Internet of things grows more vast, as devices get "smarter" and as we hand more and more of our daily tasks to automated "things," new materialism becomes increasingly valuable. In looking at athlete engagements with wearable technology, new materialism opens a space for understanding how those technologies function and allows us to shape the contours of those engagements in ways that other perspectives do not. By allowing that our things, smart or not, have agency, that they play an active role in shaping not just what we see, but how we actually do things, we are able to account for some of our missing pieces, address new questions, adopt new perspectives, and come to unique conclusions.

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Appendix A

IRB Informed Consent letter

Informed Consent to Participate in Research

Information to Consider Before Taking Part in this Research Study

Pro #00034015

Researchers at the University of South Florida (USF) study many topics. To do this, we need the help of people who agree to take part in a research study. This form tells you about this research study. We are asking you to take part in a research study that is called: Exploring the impact of wearable technology on athletic activity. The person who is in charge of this research study is Michael Repici. This person is called the Principal Investigator.

Purpose of the Study

The purpose of this study is to find out how/if the use of wearable technology affects the decisions an athlete makes during training and racing. I am interested in better understanding how and why athletes use these technologies.

Why are you being asked to take part?

We are asking you to take part in this research study because you are a member of a triathlon club and, as a result, likely use wearable technologies as a part of both your training and racing

Study Procedures

If you take part in this study, you will be asked to fill out a brief online survey through an electronic website that explains your use of wearable technology as it pertains to your participation in triathlon. The answers to this survey will be recorded and stored on a private computer. All identifiable information will be changed.

If your responses to the survey questions require it, you may be asked to participate in a short face-to-face follow up interview to further elaborate on your use of technology. This interview will take place at a location that is mutually convenient to you, the participant, and the primary investigator. The conversation will be recorded and stored in a private file. As with the survey, all identifiable information will be changed.

Alternatives / Voluntary Participation / Withdrawal

You have the alternative to choose not to participate in this research study.

You should only take part in this study if you want to volunteer; you are free to participate in this research or withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study.

Benefits and Risks

You will receive no benefit from this study.
This research is considered to be minimal risk.

Compensation

We will not pay you for the time you volunteer while being in this study.

Privacy and Confidentiality

We must keep your study records as confidential as possible. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online.

Certain people may need to see your study records. By law, anyone who looks at your records must keep them completely confidential. The only people who will be allowed to see these records are: Michael Repici, Principal Investigator, Dr. Meredith Johnson, advising professor. The University of South Florida Institutional Review Board (IRB

- It is possible, although unlikely, that unauthorized individuals could gain access to your responses. Confidentiality will be maintained to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet. However, your participation in this online survey involves risks similar to a person's everyday use of the Internet. If you complete and submit an anonymous survey and later request your data be withdrawn, this may or may not be possible as the researcher may be unable to extract anonymous data from the database.

Contact Information

If you have any questions about your rights as a research participant, please contact the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu. If you have questions regarding the research, please contact the Principal Investigator at (727) 251-7769 or contact by email at mailto:mrepici@mail.usf.edu

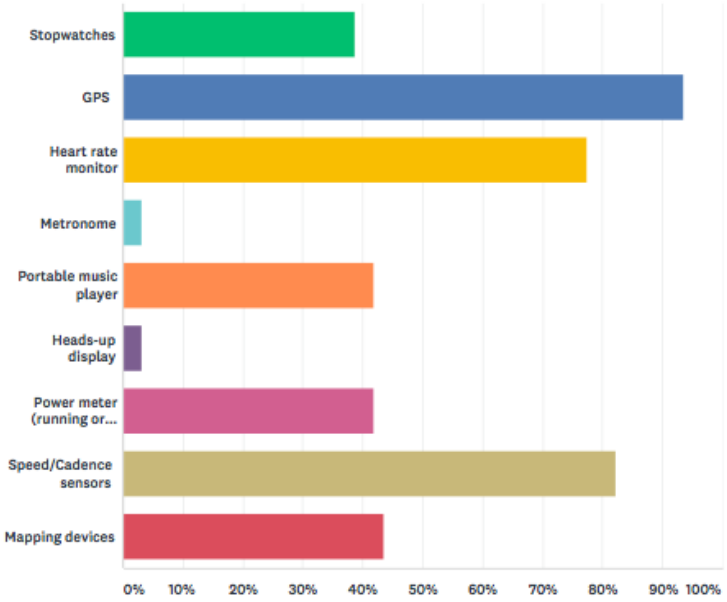
We may publish what we learn from this study. If we do, we will not let anyone know your name. We will not publish anything else that would let people know who you are. You can print a copy of this consent form for your records.

I freely give my consent to take part in this study. I understand that by proceeding with this survey that I am agreeing to take part in research and I am 18 years of age or older.

Appendix B

Survey question and response data

Q1. Either in your training or in the races, do you use wearable technology? Check all that apply:



Answer Choices	Responses	Response Percentage
Stopwatches	24	38.71%
GPS	58	93.55%
Heart rate monitor	48	77.42%
Metronome	2	3.23%
Portable music player	26	41.94%
Heads-up display	2	3.23%
Power meter (running or cycling)	26	41.94%
Speed/Cadence sensors	51	82.86%
Mapping Devices	27	43.55%
Total Respondents: 62		

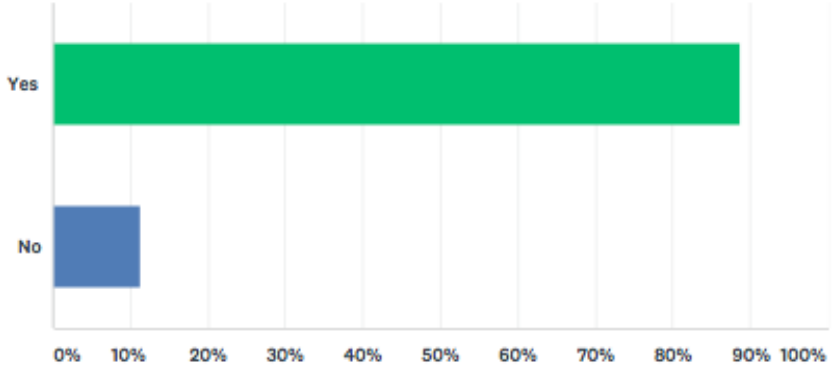
Q2. What metrics do you view or measure with your wearable technology?

#	Responses	Date
1	Heart rate, cadence, speed, duration, distance, training stress, intensity, work, power and elevation gains and losses	7/21/2018 12:30 PM
2	Heart rate, speed, cadence, distance, elevation	7/17/2018 3:34 PM
3	Cadence, speed and miles for biking. Distance and speed for running. I don't have a way to track swimming	7/16/2018 1:49 PM
4	Heart rate, time, distance, mile split	7/12/2018 8:51 PM
5	Heart rate, speed	7/10/2018 7:40 PM
6	Cadence, HR and Strokes per minute	7/9/2018 6:44 PM
7	Distance, Time, Splits, Heart Rate	7/9/2018 10:44 AM
8	HR, Speed/Pace, Distance, Time, Cadence	7/8/2018 5:06 PM
9	Timer, pace/speed, power, cadence, heart rate, distance	7/8/2018 2:31 PM
10	Time, distance, heart rate, pace, cadence	7/8/2018 1:13 PM
11	Distance, pace per mile, power zones, IFF, VI, 3 second average power, etc.	7/8/2018 1:08 PM
12	HR, speed, distance, time	7/8/2018 1:05 PM
13	Heart rate, speed, cadence	7/8/2018 1:01 PM
14	HR, distance, pace, calories burned, splits	7/8/2018 12:46 PM
15	Time, speed, distance, pace, cadence, power	7/8/2018 9:08 AM
16	Distance and pace	7/8/2018 8:42 AM
17	Running: pace and cadence. Biking: power and cadence	7/8/2018 8:12 AM
18	HR, cadence, speed, incline, swolf, pace, vertical oscillation, average pace.	7/8/2018 7:24 AM
19	Power, speed, time, distance, cadence, heart rate…	7/8/2018 6:50 AM
20	Pace/speed, HR, time (total, split), cadence, normalized power, avg power, temp, distance (total, split)	7/8/2018 5:59 AM
21	Power, distance, speed, temperature, cadence, map (bike).	7/7/2018

	Speed, distance (run). Speed, distance (swim).	9:49 PM
22	Pace, heart rate, distance, hours, stroke rate, recovery time	7/7/2018 9:21 PM
23	Speed and distance	7/7/2018 8:46 PM
24	Heart rate, Distance, Calories, Pace	7/7/2018 7:45 PM
25	Total distance for swim, bike, and run; FTP and RPM's on bike, HR and stress	7/7/2018 7:42 PM
26	Heart rate, Power output on bike, Cadence on bike and run, Speed, Distance	7/7/2018 7:32 PM
27	Time and Distance	7/7/2018 7:32 PM
28	Heart rate, speed, avg. speed, cadence, avg. cadence, mileage, pace, strokes.	7/7/2018 7:19 PM
29	Swim, bike, run speed, HR, Watts, cadence, distance, intensity, stress, fatigue	7/7/2018 7:01 PM
30	Variations of Power, HR< pace, time, distance, cadence	7/7/2018 6:53 PM
31	Depends on how the watch measures it: miles for biking and running, and yards for swimming – and I review all of them during and after each training session or race, including detailed information like split times.	7/7/2018 6:27 PM
32	Time, heart rate, miles, pace	7/7/2018 6:19 PM
33	Time	7/7/2018 6:06 PM
34	Distance, Speed	7/7/2018 4:50 PM
35	Miles – running/biking, Swimming is yards	7/7/2018 4:41 PM
36	Pace, cadence, heart rate, distance, time	7/7/2018 4:38 PM
37	Heart Rate, Power, Speed, Cadence, Distance	7/7/2018 4:31 PM
38	Watts, Ron, mph, cadence, speed, duration, fatigue, intensity factor	7/7/2018 3:34 PM
39	Heart rate, wattage, speed, route, and time	7/7/2018 3:26 PM
40	Distance. Time, Heart Rate (if I wear the monitor). Time of day (nice to know when you've been out there for 4 or 5 hours and have lost track of time).	7/7/2018 3:22 PM
41	Power, normalized power, speed, average speed, power balance, distance, cadence, time, splits, stride length, heart rate, vertical feet climbed, calories, VO2, stroke rate, strokes per	7/7/2018 3:09 PM

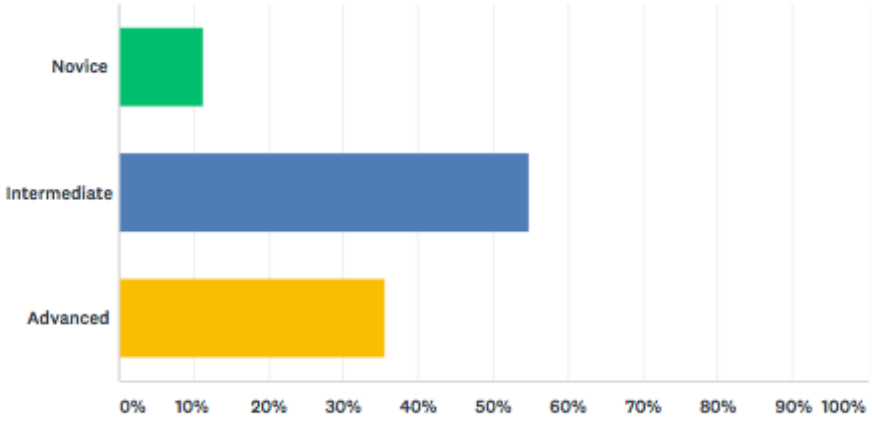
	length, swim pace per 100 yards, rest intervals, training load, aerobic effort, Anaerobic Effort, There may be more…	
42	Running: distance pace, duration, heart rate, cadence, stride length. Cycling: distance, speed, duration, heart rate, cadence	7/7/2018 2:57 PM
43	HR, pace, power outage, distance, time	7/7/2018 2:50 PM
44	Speed, lap/interval speed, activity time, overall time, heart rate all details and effort measurements	7/7/2018 2:47 PM
45	Riding speed and running pace	7/7/2018 2:44 PM
46	Time, pace, speed, Watts, heart rate, cadence, compass direction, elapsed time	7/7/2018 2:44 PM
47	Bike power, cadence, distance, time, run pace	7/7/2018 2:43 PM
48	Heart rate, pace, ground contact time, speed, elevation, distance	7/7/2018 2:41 PM
49	Cadence, Heart rate, Pace (run/swim), Speed (bike), Distance, time metrics for splits	7/7/2018 2:39 PM
50	Heart rate, distance, pace	7/7/2018 2:32 PM
51	HR, Time per mile, distance per time, total time lapse, maps	7/7/2018 2:31 PM
52	Distance, speed, power, cadence, heart rate	7/7/2018 2:23 PM
53	Miles – Garmin	7/7/2018 2:18 PM
54	Pace, distance, time, estimated power	7/7/2018 2:13 PM
55	Heart rate, speed, cadence, overall time elapsed	7/7/2018 2:08 PM
56	Speed/pace, Distance, Power, cadence, heart rate	7/7/2018 2:05 PM
57	Pace, distance	7/7/2018 2:02 PM
58	Speed, distance, time, heart rate, cadence	7/7/2018 2:01 PM
59	Heart rate, turnover rate, power	7/7/2018 1:56 PM
60	Meters, miles	7/7/2018 1:54 PM
61	Speed, Power, Heart rate	7/7/2018 1:50 PM
62	Heart rate, pulse, steps/pedometer	7/7/2018 1:49 PM

Q3. Do you use your wearable technology to track your metrics over time?



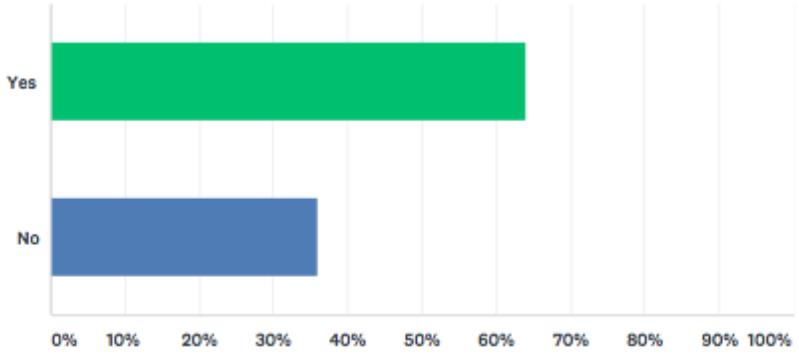
Answer Choices	Responses	Response Percentage
Yes	55	88.71%
No	7	11.29%
Total Respondents	62	

Q4. How would you rate your experience in triathlon?



Answer Choices	Responses	Response Percentage
Novice	7	11.29%
Intermediate	34	54.84%
Advanced	22	35.48%
Total Respondents	62	

Q5. Would you be willing to participate in a face-to-face follow-up interview about wearable technology and triathlons?



Answer Choices	Responses	Response Percentage
Yes	39	63.93%
No	22	36.07%
Total Respondents	61	

Appendix C

Participant table

Pseudonym	**Age**	**Experience Level**	**Technology Used**	**Metrics Tracked**	**Track over time?**
Joan	50's	Novice	Stopwatch GPS HR monitor	Distance Time Heart rate Time of day	Yes Years
Betty	40's	Novice	GPS Power meter Speed/Cadence sensors	Pace Cadence Power	No
Steve	50's	Intermediate	GPS HR monitor Power meter	Power Heart rate Pace Time Distance Cadence	Yes Years
Susan	30's	Intermediate	Stopwatch GPS HR monitor Power meter Speed/Cadence sensors	Heart rate Distance Pace Calories Splits	Yes For trends
Diana	30's	Intermediate	GPS HR monitor Power meter Speed/Cadence sensors Mapping devices Lumo run	Distance	Yes
Charlie	40's	Intermediate	GPS HR monitor Power meter Speed/Cadence sensors	Heart rate Speed Cadence Distance Elevation	Yes Years

Ernesto	30's	Intermediate	Stopwatch GPS Speed/Cadence sensors	Cadence Speed Distance	Yes Years
Amy	40's	Intermediate	Stopwatch GPS HR monitor Speed/Cadence sensors Mapping devices	Time Distance Hear rate Pace Cadence	No
Shannon	40's	Intermediate	GPS HR monitor Speed/Cadence sensors	Heart rate Speed/Pace Distance Time Cadence	Yes Months/Years
Lucy	30's	Intermediate	GPS HR monitor Power meter Speed/Cadence sensors	Distance Speed Power Cadence Heart rate	Yes 16 week training cycles
Erik	40's	Advanced	GPS HR monitor Power meter Speed/Cadence sensors	Speed Power Heart rate	No
Mark	60's	Advanced	Stopwatch GPS Power meter Speed/Cadence sensor	Distance Pace Power zones IFF VI Power averages	Yes Years
Kara	60's	Advanced	GPS Power meter Speed/Cadence sensors Mapping devices	Power Distance Speed Temperature Cadence Mapping Pace Yards	Yes. Years

Simon	60's	Advanced	Stopwatch GPS HR monitor Power meter Speed/Cadence sensors	Pace/speed HR Time (total, splits) Cadence Normalized and average power Temperature Distance (total/splits)	Yes Years