Entangled Ontologies

A sociophilosophical analysis of
technological artefacts, subjects, and bodies

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For Viriato Camacho

Hijos no me lloréis
Ya he vivido bastante
y debo compartir
mi cuota de aire
con cuantos vienen
por el largo camino.

From '*No me lloréis*', in *Huellas y Ecos*,
Viriato Camacho, 1990

Abstract

Social studies of technology—and particularly the sociology of technology—have long explored the reticulations between technology and social life. More specifically, the sociology of technology has contributed numerous studies addressing the relationship between technological artefacts and the social order. Following this tradition, feminist studies of technology have developed robust analyses of technology and subjectivity, with particular attention given to questions of gender identity. Additionally, recent work in technology studies has engaged with the problem of embodiment, both in terms of technological practice and with regard to the body as a consequential phenomenon in sociological enquiry. This thesis aims to further develop the sociological study of technological artefacts, subjects, and bodies through sociophilosophical analysis. By bringing to bear sociological methodology and theory upon fundamental questions in the philosophy of technology, this research elucidates and resolves problems relevant to both the philosophy and sociology of technology. Specifically, this thesis interrogates the manners and modalities in which technological artefacts, subjects, and bodies are rendered intelligible in social life. In doing so, it develops a symmetrical sociological analysis of these three phenomena and posits a robust solution to the question concerning ontology within the philosophy of technology.

Here, I posit a conceptualization of technological artefacts, subjects, and bodies as artificial kinds—entities underdetermined by materiality and ontologically dependent upon self-referential social practice. I argue that in using Kusch's concept of artificial kinds, we gain a useful perspective with which to discern the relationships between the ontological constitution of artefacts, the development of subject positions, and the social 'situatedness' of bodies and embodied practice. I also develop the concept of *entangled ontologies*, an analytic lens that highlights the dependence and interrelation that characterize the ontological constitution of artefacts, subjects, and bodies in social life. My analysis re-frames critical questions of technological ontology and illustrates the importance of fundamental philosophical problems to the sociological study of technology. In doing so, I am extending and amending the Performative Theory of Social Institutions—the social theory of the Strong Programme in the sociology of scientific knowledge.

My theoretical project is supported by robust empirical work, which focuses on technological experience and motorcycling in Latin America. I carried out 36 in-depth qualitative interviews with a varied sample of motorcyclists in Costa Rica, and supplemented these with ethnographic observation. This empirical work contributed substantially to the development of my theoretical argument, and constitutes a considerable portion of the argument contained within this thesis. The three primary chapters—concerned with artefacts, subjects, and bodies, respectively—make substantial use of my empirical work throughout their analytic arguments, and each chapter contains an empirical component consisting of consolidated case material. The first—on artefacts—addresses heteronormativity in the constitution of artefact ontologies. The second—on subjects—discusses the role of age and ageing in the articulation of motorcycling subject positions. Last, the empirical material on bodies addresses the role of machinic and corporeal practices in the classification and ontological constitution of bodies. All three of these components represent original contributions to technology studies. Notably, sexuality and ageing arguably remain invisible phenomena to sociologists of technology.

The empirical and analytic work contained within this thesis contributes substantially to a variety of fields. As I discuss in detail in my concluding chapter, my use of symmetrical sociophilosophical analysis presents feminist technology studies with new avenues for research, as well as new analytic tools with which to address questions of paramount importance. My use of Kusch's artificial kinds allows for a reconsideration of constructivism in technology studies, and provides a resolution to the Woolgar, Grint, & Kling debate of the early 1990s. Finally, this research presents the philosophy of technology with a new approach to the question of technological ontology, and contributes meaningfully to contemporary efforts to develop a synergetic sociological-philosophical analysis of technology.

Declaration

I hereby certify that the research contained within this thesis is my own work, and that it has not been submitted for any other degrees or professional qualifications.

Limited material from Chapter Four (*Artefacts*) has been published previously as 'The bootstrapped artefact' in *Studies in History and Philosophy of Science, Part A*. Complete citation information is included within the list of works cited (*References*).

Pablo Schyfter

Acknowledgments

"Alas, what are you after all,
my written and painted thoughts! It was not long ago
that you were still so colorful, young, and malicious,
full of thorns and secret spices…"
From *Beyond Good and Evil: Prelude to a Philosophy of the Future,*
Friedrich Nietzsche, 1886

This thesis could never have come to fruition without the support, help, and advice of a great many people during my time at Edinburgh. This achievement is as much theirs as it is my own.

First, I would like to thank the 36 men and women who gave of their time to help me conduct my fieldwork interviews. Their willingness to share their stories with me is the bedrock upon which all of my work is built.

I also want to recognize the advice and assistance of my two supervisors, Wendy Faulkner and Ivan Crozier. Their persistence and dedication helped me write at my very best, and I owe both a debt of gratitude that will not be repaid easily. Martin Kusch, David Bloor, and Irene Rafanell also contributed greatly with insightful and inspiring comments.

During my time at the Science Studies Unit, I have met a number of people who—directly and indirectly—have contributed to the research contained within this volume. I have a great deal of appreciation for my fellow postgraduates, whose company, friendship, and intellectual rigour helped make my four years in Edinburgh a pleasure. Special recognition must be given to Juan-Pablo Pardo-Guerra, Gethin Rees, and James Wood for their camaraderie and invaluable contributions to this project. Moreover, I feel compelled to single out Carole Tansley, the heart and soul of the SSU, for innumerable instances of support, countless cups of tea and slices of cake, companionship during theatre outings, and teaching me humility with regard to Shakespeare.

My family and friends from Costa Rica and California, respectively, also merit my thanks. Without their constant support, I could not have survived producing this volume. I also want to thank Betty Emirzian for love in every shape and form, and my Lonsdale Terrace family for a warm home in which to write.

My friends and colleagues at Lund University's Centre for Gender Studies aided in the final stages of my writing and left indelible impressions on all facets of my work—gender-related and otherwise.

For their lucid and insightful comments to my thesis, as well as their presence at my defence, I want to thank Barry Barnes and Maureen McNeil.

Ultimately, any faults you may find herein are my own.

Contents

"... it is only ever we ourselves, through our belief that things seen have an existence of their own, who can impart to some of them a soul which lives in them, and which they then develop in us."

From *In the Shadow of Young Girls in Flower (In Search of Lost Time, Vol. 2),*
Marcel Proust, 1919

"… the eye sees not itself
But by reflection, by some other things."

Julius Caesar (I.ii.52-53),
William Shakespeare

Chapter One: Introduction

This is a study in questioning ontologies. The research contained within this thesis is an exploration of ontologies and intelligibility as they relate to technological artefacts, subjects, and bodies as positioned entities in social life. It is concurrently a sociological study of motorcycles and motorcyclists in Costa Rica. Most precisely, it is a sociophilosophical investigation—situated within the traditions of the Strong Programme in the sociology of scientific knowledge—that seeks to address fundamental philosophical questions through robust sociological methods and argumentation.

This work systematically demonstrates that technological artefact, subject, and body ontologies are collective goods and consequently, so are the entities they render comprehensible. My research documents and explicates the systems of enablement and constraint—of social order—in virtue of which artefacts, subjects, and bodies are rendered intelligible in specific, situated modalities. In doing so, I posit a framework for symmetrically conceptualizing these entities as artificial kinds—phenomena underdetermined by materiality and ontologically dependent upon self-referential social practice[1]. I argue that artefacts, subjects, and bodies are entangled social products, constituted interdependently and rendered intelligible in relation to one another as functions of the selfsame social processes.

I here am questioning ontologies. To do so, I engage with a constellation of concepts and arguments in the service of my primary consideration and with the aim of contributing meaningful theoretical advancements to the sociology of technology. Consequently, this research is premised on diverse literatures—drawn together and made compatible through the Strong Programme's Performative Theory of Social Institutions, which is itself re-conceptualized and expanded. In the service of this analytic project, my argument extensively deploys empirical research and analyzes a triad of original case material, which represents a series of substantial contributions to the study of technological artefacts and social orders. It is from this tradition of empirical research that this study originates, and (among others) to which it responds.

[1] I use the term 'practice' expansively: as a class of activities that includes both reference and physical practice. Undoubtedly, there exist substantial differences between speech acts and physical practice, yet both are equally significant here.

1.1 Origins and aims

Initially, this thesis was to be situated wholly within feminist technology studies—specifically, sociological and anthropological feminist studies of masculinity, masculinities, and technological artefacts. I aimed to address the role played by technological artefacts in the articulation, maintenance, and evolution of masculine subjectivities while concurrently contributing to the field theoretically. In exploring the literature, developing my understanding of various theoretical traditions, and carrying out the fieldwork, the scope of my project widened, its aims were modified, and its theoretical commitments were substantially transformed. Most notably, this work has shifted ground from post-structuralist feminist theories to performative theories of knowledge and the sociology of knowledge—specifically the Strong Programme's Performative Theory of Social Institutions. Correspondingly, the primary questions addressed by the thesis have changed, from ones concerned with the social constitution of gendered subjectivities to ones focused upon the ontologies and intelligibility of artefacts, subjects, and bodies. Moreover, gender is now not the sole focus of this work. My study of technology extends to encompass age and ageing, sexuality, and the sociology of the body.

1.1.1 Disciplinary and theoretical foundations

Although this study is substantially different from its initial design, it remains indebted to and characterized by the disciplinary traditions of feminist technology studies. Most significantly, this thesis reflects and further develops the analytic framework of co-production of gender and technology. Succinctly, this theoretical and empirical tradition conceives of gender and technology as social phenomena designed, produced, used, and best understood, in relation to each other; a full understanding of gender requires an appreciation of technology, just as understanding technology demands a corresponding analysis of gender (see Cockburn & Ormrod, 1994; Faulkner, 2001). This foundational postulate heavily informs my work, although the result of my argument is a considerable transformation of its analytic equation.

Similarly, while post-structuralist feminist theory no longer dominates the theoretical approaches used in this thesis, its contributions to the development of my analysis and the form of my argument are significant. Post-structuralist feminism's insights concerning the contingency, instability, and multiplicity of gender identities deeply affected my

understanding of subjects, and its commitment to the discursive study of the body aided in part my own examination of bodies and technology. Additionally, its concern with power and distributions of knowledge was deeply useful in developing an understanding of communitarian phenomena.

From studies of men, masculinity, and masculinities (see Connell, 1995; Whitehead, 2002), I drew upon a rich cache of empirical work, as well as an insightful theoretical tradition—notably the concept of 'hegemonic masculinity' (Connell & Messerschmidt, 2005). In engaging with the dominant—indeed, the hegemonic—notion of 'hegemonic masculinity', I developed my own thinking regarding gender as a normative and symbolic phenomenon, as well as the relationship between single subjects, the community, and superordinated patterns of behaviour. Ultimately, I chose to dispense with hegemonic masculinity as my central theoretical framework—its usefulness to my research was limited and its contribution to feminist technology studies I consider exhausted. Nevertheless, the development of my analysis is indebted to Connell's substantial contributions to gender studies.

Most instrumental to the evolution of my work and the execution of this study have been performative theories of knowledge and practice[2]—which I have drawn from gender studies (Butler, 1999 [1990]), philosophy (Foucault, 2006 [1966]), epistemology (Kusch, 2002), and the sociology of scientific knowledge (Barnes, 1983). While these various works address radically different topics, employ distinct methodologies, and articulate discipline-specific questions, their consubstantiality—a concern with the performative character of knowledge and practice—justifies reconciling their disparities with a unique goal: to conceptualize and examine the ontological constitution of artefacts, subjects, and bodies. Moreover, the epistemic commonality of performative theories of knowledge—a communitarian epistemology—has significantly influenced my aims, methodology, and analysis in this study. This I detail in Chapter Three and display consistently throughout the thesis.

Other disciplines and traditions have aided in the development, execution, and writing of this research. Latin American studies has contributed substantially to my understanding of regional particularities, and has offered significant insights with regard to questions of gender and sexuality. Social studies of age and ageing—otherwise referred to as social gerontology—is centrally involved in my work on ageing and subjectivities. The sociology of the body has proffered unquestionable aid in my analysis of the ontological constitution of

[2] For an overview of performativity, c.f. MacKenzie, et al., 2007.

the body, and I have drawn considerably from phenomenology in conceptualizing and studying the corporeal and sensorial facets of embodied technological practice. I engage with these various disciplines at specific points throughout my argument.

1.1.2 Thesis aims

This thesis addresses one primary question: *in what manners and modalities are technological artefacts, subjects, and bodies rendered intelligible?* By manner I refer to the unique process of ontological constitution; by modality I refer to the character of the resultant ontologies. That is, this study is concerned with the processes by which artefacts, subjects, and bodies gain their ontologies, and the characteristics of these processes that result in the particular ontological commitments observed in social life. I demonstrate that it is possible to conceptualize these ontologies as social institutions, and artefacts, subjects, and bodies as artificial kinds (Kusch, 1997). Moreover, I argue that artefact, subject, and body ontologies are constituted as entangled phenomena, in relation to and dependent upon one another. Such a view of *entangled ontologies* correspondingly necessitates methodological and analytic symmetry, as I discuss in Chapter Seven.

This study is founded on and enacts theoretical development upon the Strong Programme in the sociology of scientific knowledge. I make use of this research tradition's Performative Theory of Social Institutions to analyze technological artefacts, subjects, and bodies as artificial kinds. In doing so I further develop and expand the Strong Programme, by extending the scope of its application and re-imagining core concepts such as symmetry and finitism. My use of and work on this tradition are in service of the primary research question, but represent significant achievements in their own right. The theoretical discussion also contributes to a number of other disciplines, as I detail in Chapter Eight.

In service of this analysis, the empirical work functions to address my concern with ontologies and intelligibility. This study's empirical component consists of a qualitative sociological examination of motorcycles and motorcyclists in Costa Rica, with particular emphasis upon the relationships between agents, technological artefacts, and social orders. In sociologically documenting the agent-artefact relationship in motorcycling, I employ the empirical fieldwork as an engine to drive my project in theoretical development. However, the multitude of interviews and ethnographic observations contribute originally in and of

themselves to various disciplines in ways highlighted throughout my analysis of the fieldwork.

In addressing and resolving my primary question, I also achieve a series of secondary aims. While not the central goal of this thesis, these secondary considerations are necessary components of my argument.

In drawing upon a sociophilosophical approach to the study of artefacts, subjects, and bodies, I demonstrate that *fundamental questions concerning ontology have social answers*. The study of these core problems must develop sociological solutions.

Correspondingly, this study demonstrates that *technology is part, parcel, and product of social life*. That is, I determine that a robust study of technology must begin with a fundamental premise: that technology is a social phenomenon, and can in no way be understood as distinct from, influenced or transformed by, nor in a mutual-shaping relationship with, society. All of these approaches necessarily excise technology—be it in the form of knowledge, artefacts, or practices—from society, and set it as existing in an external or semi-external relationship to social life. My sociology of technology holds that outside society, technology does not exist. The researcher is beholden to study technology as he/she would other social practices or institutions. This claim is congruent with the Strong Programme's analysis of science and scientific knowledge, which I discuss in Chapter Three and employ thereafter.

Lastly, I aim to *contribute to feminist technology studies* with new empirical material as well as through theoretical innovation. The empirical work included within this thesis in part addresses heteronormativity and artefacts, and ageing, masculinities, and technology. This case material provides new insights into the question of gender and technology, and is congruent with recent and burgeoning programmes of research in feminist technology studies. With respect to theoretical innovation, my work demonstrates the methodological and analytic superiority of the Performative Theory of Social Institutions over the co-production formula that has dominated and remains pre-eminent in feminist studies of technology.

1.2 Sociophilosophy, ontology and ontologies

As I note above, and as is evident throughout this work, my research draws from both philosophy and sociology, and synthesizes a variety of useful tools from both disciplines. Doing so is no simple matter, as significant divergences in research foci, methodologies, and analyses characterize the relationship between philosophy and sociology. Importantly, my work is not an attempt to join 'pure' philosophy and 'pure' sociology—rather, I draw upon and elaborate sociophilosophy, an approach concerning which some exposition is now demanded.

Sociophilosophy is most extensively discussed and employed by Martin Kusch (1996, 1997, 1999, 2000), whose work forms the basis for the majority of this thesis. More than simply a synthesis of disciplinary traditions and methods, sociophilosophy implies a unique approach to the study of knowledge, as well as the premises that must underlie such research and the methodologies necessary to carry it out. Writes Kusch:

> Sociophilosophy, we might say more generally, is that school of philosophy whose adherents believe that much of what is needed to answer the grand old questions of epistemology must come from sociological enquiry. (Kusch, 2000: 15)

Sociophilosophy, as defined by Kusch, aims to resolve epistemological questions by the use of sociological methods and explanations, alongside other contributing fields such as history and anthropology.

The present study builds upon this definition of sociophilosophy and extends the locus of relevant problems. My concern with the ontological constitution of technological artefacts, subjects, and bodies—with the manners and modalities in which these become intelligible—implies a somewhat modified definition of sociophilosophy. Like Kusch, I believe this approach fundamentally concerns the resolution of philosophical questions through sociological enquiry. It begins with a foundational premise:

> … it holds that human beings are social creatures, that, to borrow a phrase from the literature of cultural studies, they are 'highly gregarious interdependent social primates'… (Barnes, 2000: ix)

The sociophilosophy of this thesis continues by embracing Kusch's—and more broadly the Strong Programme's—assertion that knowledge is a social phenomenon and should be

studied accordingly. However, I also suggest reversing the proposition. Sociological enquiry is necessary to address philosophical problems; concurrently, sociology benefits from philosophical questions. In exploring problems of ontologies and intelligibility, sociology gains a new and highly useful understanding of social life. Thus, this study aims to use problems of ontology—philosophical questions—to render an original description and explication of social practice. The methods and analytic tools are sociological; the foundational questions are philosophical; the study is one in sociophilosophy.

This is a piece of research into ontologies—those of technological artefacts, subjects, and bodies. Having defined the basics of sociophilosophy, it is incumbent upon me to define now the character of the fundamental questions I aim to address. I understand an artefact's (or a subject's or a body's) ontology as our comprehension of its being. I argue that our situated conception of an artefact's (or a subject's or a body's) being is analytically indistinguishable from more traditional definitions of ontology, which emphasize an entity's metaphysical condition of existence. Consider philosopher Lynne Baker's discussion of ontology and existence:

> An F has ontological status in virtue of being an F only if the F's existence depends on its being an F. For example, your bicycle has ontological status in virtue of being a bicycle because *it* would not exist at all if it were not a bicycle. By contrast, the items in your pocket have ontological status in virtue of being coins, handkerchiefs, keys, etc., not in virtue of being items in your pocket, because they would (and most likely did) exist without being items in your pocket. What has ontological significance in the first instance are properties—primary-kind properties. (*Item in a pocket* is not a primary kind.)… a bicycle cannot lose the property of being a bicycle without going out of existence. So, primary-kind properties bestow, on those whose primary-kind properties they are, ontological significance. (Baker, 2004: 107, emphasis original)

In Baker's terms, this study explores the primary-kind property of being-an-artefact (or being-a-subject or being-a-body)[3]. Put otherwise, the fundamental primary-kind property with which this study is concerned is that of artefact *qua* artefact (or subject *qua* subject or body *qua* body)[4]. My work explores the manners by which these properties come into existence and the modalities they take. I argue and demonstrate that ontological significance is a product of social practice, and that the primary-kind properties Baker discusses exist

[3] "Being—that which determines entities as entities, that on the basis of which [woraufhin] entities are already understood, however we may discuss them in detail. The Being of entities 'is' not itself an entity... Being lies in the fact that something is; and in its Being as it is..." (Heidegger, 2005 [1927]: 25-26)

[4] I do not hold, as do Baker and other philosophers, that the onus of ontological significance rests with function. See Schyfter, 2009.

only within collectives of mutually-susceptible agents.

I am not concerned in this work with metaphysics. I do not discuss or seek to prove the physical existence of artefacts, subjects, or bodies, but rather hold it as a precondition for my sociophilosophical research[5]. Neither do I aim to justify the ontological respectability of artefacts, subjects, and bodies in relation to natural entities such as trees, rocks, or birds. I feel no compulsion to act as an ontological advocate for my research foci, and I do not believe that artefacts, subjects, and bodies are analytically indistinguishable from or possessed of the same ontological bases as natural entities—as I argue closely below. Finally, I do not seek to identify the core essence of artefacts, subjects, and bodies. I do not hold that there exist immutable, ideal qualities that define these entities, but rather conventional practices in communities of agents. As a study committed to sociological explanation, this thesis explores the place of artefacts, subjects, and bodies *in social life*[6], and consequently draws attention to the constitution of ontologies through collective practice.

Succinctly stated, the ontologies studied here are the situated conceptions of an entity's being. Effectively, they are responsible for that entity's existence and, importantly, they are social phenomena through and through.

1.3 Thesis structure

This introduction establishes the fundamental bases upon which this study develops. Chapters Two and Three further detail central components of my research design and argument. Chapters Four, Five, and Six constitute the argumentative and empirical portion of the thesis. Chapter Seven integrates my analytic arguments into a conceptualization of artefacts, subjects, and bodies as entangled phenomena. Chapter Eight proffers implications. In detail, the thesis proceeds as follows:

Chapter Two, *Strategies*, concerns my research methodology. The first two sections address my two major empirical choices—namely, that of the motorcycle as the case technological artefact and Costa Rica as the fieldwork location. Within these sections, I discuss my motivations for choosing these particular research foci. The third section outlines my methodology. I discuss the procedures I employed and the benefits provided by in-depth

[5] This is ontological, not ontic, research.
[6] As such, I do not address Being and technology as does Heidegger (2005 [1927], esp. III.15 and 2003 [1954]).

qualitative interviews and ethnographic observation. Finally, I provide a summary of the interview sample, characterizing it by sex, age, income level and profession, motorcycle type, and group affiliation.

Chapter Three, *The Strong Programme's Performative Theory of Social Institutions*, amends my discussion of methodology with a comprehensive overview of the theoretical framework I employ and further develop. I begin with a succinct treatment of the Strong Programme in the sociology of scientific knowledge, within which I address the major tenets of the Edinburgh School. After this brief examination, I provide an analysis of the Performative Theory of Social Institutions (PTSI). I address fundamental and crucial ideas—namely, classification, self-referentiality, performativity, bootstrapping, normativity, social institutions, and finitism. I then discuss Martin Kusch's invaluable contributions to the Strong Programme, which drive much of my work.

Chapter Four, *Artefacts*, is the first of three argumentative chapters. Using empirical data and systematic analysis, I demonstrate that artefact ontologies display the five characteristics of a social institution. Technological artefacts consequently are amenable to analysis as artificial kinds—a concept detailed in Chapter Three and central to this volume. Following this argument, I address Quine's notion of underdetermination and provide a robust argument concerning its applicability to the question of technological artefacts. The second half of the chapter is devoted to case material with which I argue that artefact ontologies are susceptible to patterns of heteronormativity. This second major component of Chapter Four is comprised by an overview of studies on heteronormativity, their relevance to studies of gender, sexuality, and Latin America, and finally a study of the heterosexual imperative in agent-artefact interaction.

Chapter Five, *Subjects*, proceeds along similar lines to Chapter Four. I employ a comparable approach to demonstrate that subject positions—subjectivities—are social institutions, attributed by and intelligible only within collectives. As such, subjects can be understood analytically as artificial kinds. After a methodical argument to this effect, I address an area of major concern for communitarian analyses of subjects: self-knowledge. Drawing from the works of Martin Kusch, Judith Butler, Michel Foucault, and Ian Hacking, I argue that self-knowledge is amenable to a communitarian epistemology. The second half of Chapter Five is devoted to case material that substantiates my argument concerning the social basis of subjectivities and which specifically addresses the issue of age and ageing in the constitution

of subject positions. I provide overviews of work on the social study of age and ageing, and research on ageing and masculinities in Latin America. Finally, I develop an original account of the relationships between ageing, masculinities, and technological artefacts.

Chapter Six, *Bodies*, presents a modified structure to those of Chapters Four and Five. Previous work has already demonstrated the feasibility and usefulness of a Strong Programme analysis of the body (see Rafanell, 2003). As such, rather than develop a repetitive argument, I summarize Irene Rafanell's analysis of the sexed body as a social institution. I then discuss the manner in which her analysis of sexed bodies can be extended to an analysis of all bodies as artificial kinds. Following this argument, I address a variety of themes relevant to the study of the body in relation to technology. I discuss the corporeal facet of motorcycle riding as it relates to physical experience and to the senses, before turning to an analysis of the ontological constitution of the body—first, as a limiting factor during ageing and second, as a mechanical component of hybrid agent-artefact interaction. The diverse case material demonstrates that physical interaction is a substantial element in the ontological constitution of the body. The chapter also contains a review of work on technology and the body, used to contextualize my own empirical and analytic contributions to the field.

Chapter Seven, *Entangled Ontologies*, draws together the various arguments concerning technological artefacts, subjects, and bodies with the aim of articulating a robust social theoretical framework. This chapter constitutes the end result of my various analyses. I discuss the interpositivity of the various social processes that enable artefact ontologies, subject positions, and body ontologies and in doing so, develop the analytic tool of entangled ontologies. The remainder of the chapter discusses the nuances of this framework—such as its relationship to questions of social order, power, and practice—and responds to possible critiques.

Finally, Chapter Eight, *Implications*, assesses the significance of entangled ontologies within three loci of social and political research—feminist technology studies, the sociology of technology, and the philosophy of technology. I first critically engage with the concept of 'co-production' in feminist technology studies and posit entangled ontologies as an improvement. Second, I discuss the role of constructivism within the sociology of technology by reviewing the Woolgar, Grint, and Kling interpretivism debate and noting the potential for a sociophilosophical resolution to this important discussion. Third, I discuss

social theory within the context of the philosophy of technology, and advocate my work as a meaningful advance to philosophical examinations of technological artefacts. I then conclude the thesis with a comment on the role of my work within the Edinburgh School.

1.4 Questioning ontologies

In this thesis I am questioning ontologies. The core analytic modules of my research—Chapters Four, Five, and Six—engage with and systematically explore the manners in which artefact, subject, and body ontologies are constituted, respectively. Each chapter also explores particular ontological modalities, thus resolving the second component of my primary research question and illustrating the operation of social orders in relation to artefacts, subjects, and bodies. In questioning ontologies, I address fundamental philosophical and sociological concerns with technological artefacts, subjects, and bodies. I render these entities as entangled phenomena that exist in relation to and dependent upon one another. In order to do so, I study each as an artificial kind—a concept detailed in Chapter Three. While my aims are primarily theoretical and analytic, they are grounded in and evidenced by empirical work with motorcyclists and motorcycles in Costa Rica, and my empirical research constitutes a considerable portion of this volume. As a project in sociophilosophy, this study begins with and is premised upon sociological research methods.

Chapter Two: Strategies

Although principally concerned with sociophilosophical analysis, this thesis is grounded in detailed empirical work. My concern with ontologies and my emphasis on the uses of the Strong Programme for the study of artefacts, subjects, and bodies are based upon empirical fieldwork carried out from July 15th through October 5th, 2007. While not the predominant concern of this thesis, the empirical work nevertheless is a central element of my research.

Recall that this volume's central concern is that of discerning and interrogating the manners and modalities in which technological artefacts, subjects, and bodies are rendered intelligible in social life. The interviews and empirical observation that constituted my empirical research aimed at exploring the properties of being-an-artefact, being-a-subject, and being-a-body through sociological methodology in the service of my sociophilosophical project.

This chapter attempts to address two concerns: I justify my methodological strategies, and describe their execution and immediate results. I provide a rationale for both my choice of artefact—the motorcycle—and my choice of research location—Costa Rica. I then discuss methodological concerns by addressing and justifying my research design, and detailing its execution. Finally, I describe the resultant participant sample, noting its makeup in relation to sex, age, income level and profession, motorcycle type, and group affiliation.

2.1 Choices: Motorcycles

My choice of technological artefact was motivated by a series of strategic considerations, but was also influenced by the existing literature on automobility. Specifically, I was prompted by the considerable gaps present in science and technology studies (STS) research on motorcycles and technological experience.

Scholarly research on automobility has approached the topic from a myriad of perspectives and consequently has rendered a comprehensive literature on this facet of social life. Featherstone's review of the literature on 'automobilities' encapsulates the variety of approaches and topics (2004), several of which have particular relevance to this thesis. Urry's work on the system of automobility (2004), while characterized by a strong commitment to technological determinism—consider his notion that systems of automobility

are autopoetic—nevertheless provides a comprehensive analysis of the vast constellation of practices, institutions, and effects of these technological artefacts. Work on cultural aspects of automobility—such as that by Gartman (2004) and Miller (2001)—has demonstrated the conventional character of these technologies, as well as their historical contingency. Other work has focused on individualistic aspects of automobility. Sheller's work on 'automotive emotions' (2004) is particularly relevant to my empirical material on usage, as she analyzes experiences of pleasure, rage, thrills, and security in relation to technological experience. Her 'emotional sociology' was of considerable influence in crafting my research. Other work on the individual experience of driving has explored the phenomenological facet of automobility, particularly the manners in which sensory experience is altered through the use of these technologies; Bull (2004) and Dant (2004) have each considered the problem. This topic I explore in Chapter Six, and forms a central component of my work.

This existing literature contributed significantly to my decision to study motorcycles, yet a more salient consideration was the lack of work that specifically addresses motorcycles rather than cars. The latter are a more prominent focus of academic research on automobility. Most of the literature on motorcycles is constituted by popular narratives, often autobiographical (e.g. McGregor & Boorman, 2008; Paulsen, 1997), or cultural studies of motorcycles (e.g. Drewery, 2003; Packer & Coffey, 2004). The latter unfortunately offer little for the sociology of technology. Notable exceptions in this gap in the literature include anthropologist Ulf Mellström's studies of motorcycling mechanics and gender (2003, 2004) and sociologist Suzanne MacDonald-Walker's research on motorcycling groups in Britain and their efforts at political lobbying (2000). Both of these exemplary ethnographic works contribute substantial empirical data, as well as useful reflexive analyses of the researcher as participant-amongst-motorcyclists. This aided my own fieldwork and my post-research analysis. Ultimately, the conspicuous gap in the literature on motorcyclists—particularly within STS—significantly influenced my choice of artefact.

However, other considerations were of greater influence in designing my project.

2.1.1 A mundane artefact

The theoretical tools employed and developed within this thesis together form a social theory of technological artefacts, subjects, and bodies and the social processes that underlie their ontologies. These topics are best addressed by studying an artefact not limited by strict

specialization and thus not greatly isolated from wider social life. A mundane artefact—such as a motorcycle—satisfies my need for a machine involved in a broad locus of social activities.

In order to research the social bases of artefact, subject, and body ontologies successfully, this study also focuses upon omnipresent social orders—such as heteronormativity. There was a need to identify, describe, and explicate everyday social practices in order to engage with the character of these phenomena in relation to technology (see Michael, 2006). The choice of the motorcycle afforded me the opportunity to examine broad social practices and community-specific activities simultaneously.

Choosing a mundane technology was also a first step in the direction of addressing the quotidian interdependency of artefacts, subjects, and bodies—a central analytic claim of this thesis and the topic of Chapter Seven. By examining a routine machine, I hoped to access empirical material with which to speak of subjects and bodies as ontologically entangled with technological artefacts.

2.1.2 An interactive artefact

A study of ever-present social practices necessitates a study of interaction: of the many instances of practice that occur between motorcyclist, machine, and any satellite technologies (such as helmets, gloves, or mechanical accessories). Moreover, studies that make use of participant observation fundamentally look to interaction as the principal source of empirical data.

The scholarly literature on use and users of technology (see Oudshoorn & Pinch, 2003) indicates the importance of use as an element in the development, construction, dissemination, and appropriation of artefacts in societies. It is in the practices of motorcyclists—physical and otherwise—that the researcher can come to understand the motorcycle. Moreover, usage—technological interaction—constitutes one foundation upon which social orders are developed and maintained.

As such, it was paramount to find a technological artefact with patterns of interaction both pervasive and easily examined. The motorcycle offered both. Unlike other technological artefacts, the motorcycle requires constant attention—both on and off the road. Moreover,

the variety of forms that this interaction takes—for instance, physical, discursive, or emotional—proffer substantial and rich empirical data for analysis.

Finally, by studying the varying patterns of practice associated with different agents and communities, it becomes possible to examine the technological artefact in a more complete manner as a product of social practice. Thus, interaction provides a lens through which to explore the ontologies of machines, and with which to develop a theoretical framework capable of explicating this class of entities in relation to the subjects who operate them and the bodies with which they do so.

2.1.3 A communitarian artefact

Any social theory is ultimately concerned with communities and intersubjectivity; social life is fundamentally premised upon the gregarious character of human beings—as I note in Chapter One. Moreover, the Performative Theory of Social Institutions is epistemologically communitarian (Kusch, 2002); its practitioners are concerned with the social bases of knowledge and the collective origins of individual practice. Communities matter, both analytically and methodologically.

I argue that technological artefacts, subjects, and bodies are ontologically localized phenomena. That is, they are products of the same collective practices. Below, I further elaborate upon my claim regarding the social character of these three ontologies—an argument posited upon the communitarian epistemology of the Strong Programme and requiring an empirical strategy concerned with communities.

The motorcycle, as a technological artefact associated with various formal and informal communities, functions as an effective case artefact. By examining the relationship between machines, agents, and the collective, this study further develops my understanding of artefacts, subject, and bodies as interdependent social phenomena. Below, I discuss the central role that motorcycle groups played in this study.

Finally, a significant component of my analysis concerns normativity, a phenomenon dependent upon communities for its existence. No argument regarding norms and normativity can ignore the collective origin of sanctioning, rules, and rule-following (see

Bloor, 1997b). As such, the artefact chosen for this study required associated communities of practitioners. With the motorcycle, I satisfied this requisite.

2.1.4 An embodied artefact

Finally, I sought to examine a deeply embodied technological artefact. As a study of the entangled ontologies of artefacts, subjects, and bodies, this project could not ignore the importance of embodiment. Moreover, my empirical foci—heteronormativity, age and ageing, and embodiment—demanded such a concern. The sexed, gendered, and sexualized body is at the core of contemporary gender and sexuality studies, and as such is a problematic not acceptably elided. Moreover, no study of age and ageing can dismiss the physical process and experience of ageing bodies or the discursive facets of embodied age. Chapter Six is entirely concerned with the embodied experience of technological use, and its relationship to the ontological constitution of the body.

This study looks to the material substrate and material experiences as fundamental components of any sociology of technology. It is not possible to examine bodies without the physical experience of embodied practice any more than it is warranted to study artefacts without engaging with the machinic and physical nuances of operating them.

This thesis explores the analytic congruency of subjects, bodies, and artefacts, and aims to develop a social theory to explicate the entangled nature of all three in social practice. Without a suitable grasp of the body as sociologically problematic, such a study would be incomplete.

2.2 Choices: Costa Rica

My second principal methodological decision concerned the location for my empirical research—Costa Rica. Having chosen a mundane artefact, the limits to my fieldwork site were comparably few; as such, I sought to identify a locale in which I could achieve best the aims of my project as well as one which would contribute new material to a discipline somewhat saturated with case studies. Before I turn to strategic considerations, a few notes on Costa Rica itself are advisable.

The Republic of Costa Rica is one of five nations constituting Central America[7], located between Panama—to the south—and Nicaragua—to the north. As with the majority of Central American nations, Costa Rica is contiguous with both the Pacific Ocean and the Caribbean Sea. Although this small nation of 4.5 million citizens is constituted by a number of varied geographical regions—including two very disparate coastal regions, an arid northwest, extensive tropical forests, and a central chain of volcanic mountains—this study focuses on the Central Valley. This region is the political, economic, geographical, and population centre of Costa Rica. The capital, San José, is encircled by other major cities, including Cartago, Heredia, and Alajuela. This grouping of cities is home to the vast majority of Costa Ricans. Unlike the remainder of the country, the Central Valley is a temperate region, with annual temperatures significantly lower than the coastal regions. This section of the country is geographically isolated from the rest by the mountains that define its extent, and is often characterized as socially and culturally removed from other regions of Costa Rica. While motorcyclists often travel extensive distances in one day, covering considerable sections of the country, all of my participants currently live in the Central Valley.

The history of Costa Rica is both similar to and distinct from the other Central American nations. During Spanish colonialism, Central America formed a single geopolitical region; when Spanish rule faltered in Mexico in 1821, it did so for Central America as well. After a brief period of unity, the various constituting states disintegrated, resulting in the emergence of El Salvador, Guatemala, Honduras, Nicaragua, and Costa Rica. In its colonial history, Costa Rica features limited differences with respect to the rest of Central America. Its 20th century political history, conversely, is unique for the region. Costa Rica suffered dictatorial rule in the first half of the century, and underwent civil war in 1948. However, since that conflict Costa Rica has benefited from continuous democratic governance, and was not afflicted—as were the other Central American nations—by the dictatorships and civil wars of the late 20th century. Much of this history has contributed to a myth of Costa Rican exceptionalism (Palmer & Molina, 2004), as has the nation's constitutional abolition of its military. Nevertheless, the notion of Costa Rican uniqueness is justified only in a very limited sense.

[7] Central America is generally defined by a common geopolitical history and the Central American Common Market. Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua formed a single administrative region during Spanish colonialism. Belize was controlled by Britain and Panama was part of Colombia, and are thus excluded.

Contemporary Costa Rica can boast of a comparably successful and diversified economy—including cash crops, electronics, and a considerable service and tourist industry—and continuing political stability. Its recent adoption of the Central America Free Trade Agreement has further established the close links between the nation and the United States—a close economic partner of and a substantial cultural influence upon Costa Rica.

Further details concerning Costa Rica—particularly those concerning gender and sexuality—are included in the respective sections of the thesis below. More important at this stage is my strategic decision to study motorcycling in Costa Rica.

2.2.1 Latin America in the sociology of technology

As with much of STS, the sociology of technology has paid little or no interest to researching Latin America. More specifically, feminist technology studies has failed to substantially explore Latin America, despite an increased concern with case studies that examine gender and technology outside the traditional sites for enquiry—Europe (e.g. Cockburn, 1999; Oudshoorn, 2003) and North America (e.g. Oldenziel, 1999). A survey of relevant literature yielded a single study of masculinities and technological artefacts; Bolton's study of machismo and the symbolism of truck names in Peru (1979) was carried out a decade before the central tenets of feminist technology studies were postulated. The reticence with which researchers in the sociology of technology have approached this geographic area can be characterized best as frustrating. Similarly, scholars working in Latin America have yet to begin addressing these issues in a manner relevant and beneficial to this present work. Put succinctly, sociological studies of technology in Latin America are effectively absent from the literature.

This want of research suggests that sociological studies of technologies in Latin America will significantly advance the field. In studying this region, I sought to remedy the pronounced gaps identified above, as well as to contribute the first sociology of technology in Costa Rica. This thesis then is an original contribution to analytic and theoretical work on technologies, and a novel addition to the empirical literature in social studies of technology.

2.2.2 Preponderance of motorcycles

The history of automobility in Costa Rica does not feature the motorcycle prominently. For most of the twentieth century, motorcycles were rare methods of transportation, for a variety of reasons. The limited number of manufacturers and suppliers resulted in comparably high costs. The lack of a motorcycle service infrastructure—locales at which to purchase replacement parts or consult trained mechanics, for instance—resulted in high maintenance costs. Additionally, Costa Rica's tax and duty policies placed significantly high premiums on purchasing motorized vehicles, and motorcycles were subject to particularly elevated import taxes. Lastly, the quality of Costa Rica's transport infrastructure—including roads and service stations—was such that larger vehicles, such as four-wheel drive automobiles, broadly fared better.

A number of these limitations to the motorcycle disappeared or were significantly diminished during the volatile economic period of the 1980s. Import duties—while to this day particularly high—were lowered. Moreover, the emergence and eventual dominance of the Japanese automotive industry introduced a number of 'copycat' motorcycles—based upon American designs but produced at lower cost. These were much more affordable than their American and European predecessors. Slowly, the number of motorcycles in the country increased, and with it did the number of service providers, further enhancing the appeal of this form of transportation. The use of motorcycles by couriers also contributed to the artefact's ubiquity within the Central Valley.

During the 1990s, the number of motorcycles continued to grow, and over the last 10 years, has expanded dramatically. The increasing number of young professionals has been accompanied by a demand for low-cost methods of transportation. Correspondingly, Costa Rica's streets now carry a considerable number of scooters and small motorcycles. Moreover, the explosion in car ownership has resulted in frequent gridlock and the near-collapse of San José's road infrastructure. Motorcycles are capable of navigating through dense traffic and thus circumventing traffic delays. The increasing cost of gasoline has also encouraged more fuel-efficient forms of transportation, and motorcycles are comparably efficient motorized vehicles. Last, the country's general economic success over the period introduced a considerable amount of expendable income, which for some motorcyclists was a necessary precondition to purchasing an expensive machine for recreational purposes.

The rapidly growing population of motorcyclists, along with the development of numerous motorcycling organizations, made Costa Rica a good location for my research.

2.2.3 Ease of access

The increasing popularity of motorcycles in Costa Rica—both for transport and recreation—has resulted in a vast constellation of organized motorcycle groups, the earliest of which date back to the 1980s. These communities are as varied and differentiated as the riders who constitute them. Membership requirements, organizational structure, and conventional practices all serve to distinguish the many motorcycling groups of the country.

With regard to my study, the prevalence of organized motorcycling in Costa Rica constituted a methodological benefit. Although distinct, motorcycling clubs in Costa Rica retain strong ties to each other through occasional social events and frequent interaction on the road. Consequently, gaining access to specific 'gatekeepers' of one group almost always yielded a plethora of further contacts and potential interview participants. Moreover, the internal unity that characterizes the majority of these groups contributed to my garnering participants once I had made initial contact with a single group member. Both of these facets of group motorcycling in Costa Rica contributed to my choice of a 'snowball' approach to identifying potential participants, and were invaluable in developing the necessary cache of empirical data.

Other factors relating to ease of access contributed to my choice of Costa Rica. There existed no language barrier between the participants and myself—Spanish is my native language. Additionally, Costa Rica is my native country[8], and I could depend on logistical support from family members, thereby reducing my research costs significantly. My cultural familiarity with Costa Rica helped me design an appropriate interview protocol, carry out the work, and come to terms with the results. This was particularly beneficial in documenting and analyzing local conventions. Finally, I was already familiar with a number of motorcyclists in the country, and they contributed to identifying my initial interview participants.

[8] For a discussion of the researcher in his home culture, with particular relevance to Latin America, see Archetti, 1999.

2.3 Methodology

This project questions ontologies by applying the Performative Theory of Social Institutions to the study of technological artefacts, subjects, and bodies. Its primary purpose is analytic, not documentary. Nonetheless, the empirical component of this research operates as the basis upon which my broader work in sociophilosophy proceeds; while ultimately a theoretical enterprise, the project is dependent upon and makes substantial use of empirical sociological data.

This study made use of two methods of qualitative data collection—in-depth semi-structured interviews and participant observation. These two approaches were chosen for their adaptability to the aim of this research. The Strong Programme's interest in intersubjective practices requires a sociological methodology capable of elucidating communitarian phenomena; additionally, my interest in topics such as gender, sexuality, and age required a research method amenable to social orders that—while constituted at the collective level—are experienced individually. Importantly, the use of interviews as well as participant observation allowed me to examine both referential practice and physical practice, and to study the multitudinous links between the two—a topic I address throughout the argumentative portions of this thesis. The combined strategy also provided me with alternative and complementary sources of data, which improved the quality of the overall empirical project.

Each approach has its difficulties. In-depth qualitative interviews necessarily privilege depth over breadth. The total number of participants is curtailed by not attempting a wide distribution of survey questionnaires, and a distorted representation may be the result. Moreover, in-depth interviews are individualistic in their construction; unlike focus groups or ethnographic methods, they focus less upon collective practice and more upon a single agent's account. These concerns are addressed below.

Similarly, ethnographic observation is burdened by a number of limitations. Foremost are those of accessibility and participation, which may be limited given the particular collective under study. Second, this method is necessarily less structured and controllable than that of an interview, as little or no chance exists for pauses and clarification in conversation. Last, my choice not to pursue multi-site ethnography (c.f. Marcus, 1995) in favour of a single

group perhaps resulted in unrepresentative data. These difficulties are likewise discussed below.

2.3.1 In-depth interviews

The primary method for data collection consisted of in-depth qualitative interviews carried out with Costa Rican motorcyclists. The interview protocol—included as Appendix C—was semi-structured, and the questions were open-ended. Here, I briefly comment on my choice of interview methodology. Information on the procedure itself can be found under sub-section 2.3.3.

The central aim of this research—the study of ontologies—was best served through in-depth interviewing. Recall my definition of ontologies from Chapter One: ontologies are situated conceptions of an artefact's (or a subject's or a body's) being. Addressing the topic consequently required a method capable of rendering comprehensive data on participants' understanding and conceptualization of the social world and the entities found within it. In-depth interviews provide the necessary expansiveness of topics and detail in description for such a project.

Moreover, the range of topics I intended to address with my empirical work—for instance, learning, the experience of riding, technological passion, the collective experience, and stereotypes—required a methodology that privileges depth over breadth. While I intended and managed to secure a broad representation of Costa Rican motorcyclists in my sample, I was not preoccupied with a numerically large group of participants. The complex set of themes I addressed and the specificity with which my participants responded to my prompts were possible only though in-depth interviewing (Legard et al., 2003). Alternate methods would have been incapable of rendering the level of empirical depth necessary for my analytic work. In order to reap quality data on the agent-artefact relationship, a method less impersonal than surveys or structured interviews was required; for instance, the emotional relationship is supremely important (Bondi, 2007; Hemmings, 2005), and satisfactorily accessible only through extended, in-depth interviewing—during which confidence can be established gradually between the interviewer and the participant.

This latter argument also advocates the use of a semi-structured and open-ended approach to the interview protocol. The multi-faceted and idiosyncratic character of each individual's

relationship with his/her motorcycle demands an adaptive research methodology. By using semi-structured, open-ended interviewing, I was able to pose broad questions equally to all participants, yet allow for diverse responses to ensue (Seidman, 1998). Each participant reframed the questions in different manners, and with further prompting on my part, exhaustively reported his/her thoughts on the issues. Thus idiosyncratic phenomena received the methodological elasticity they require in order to be articulated fully.

2.3.2 Observation

The second component of my methodology comprised participant observation with a community of motorcyclists. Using ethnographic research methods, I joined the BMW Motorclub for a series of outings and an inter-group charity rally. Participant observation was an important component of my research design, and contributed substantially to my empirical work—for instance, in revealing the importance of shared meals, the character of 'joking around', and all manner of physical practices.

I chose to incorporate this ethnographic approach into my research design for a series of reasons. First, an ethnographic approach assisted me in documenting localized social interaction. As my research is epistemically communitarian—thus fundamentally concerned with social practice—I required an approach with which to explore sociality in motorcycling communities. Second, participant observation gave me the opportunity to research the active physicality of drivers[9]; my interest in the body, and in the embodied knowledge and practices of technological interaction, demanded a dedicated exploration of these phenomena as they occur (Michael, 2006). Third, this method allowed me to study interview participants in an environment within which they felt less self-aware; the ethnographic data was less stymied by the artificiality of the interview setting (Burawoy, 1998). Last, by engaging with the group, by experiencing the ride, by socializing on the terms of the community, I gained an ability to comprehend more fully some of the responses given me by the participants. I was particularly fortunate to develop a working knowledge of the technological experience in this way.

Participant observation with the BMW Motorclub offered a series of benefits. First, the group schedules outings with a greater frequency than most other groups in Costa Rica; unlike, for instance, the Harley Owner's Group—which plans one trip every month—the

[9] Here, the term 'drivers' refers to *motorcycle* drivers.

BMW Motorclub meets and rides once every week. Second, I interviewed a number of this group's members, and thus was familiar with the participants and the organization's regulations and general worldview. Third, the group was extremely welcoming to my work, and did not hesitate to grant me permission to join them; this in contrast with several other groups, whose reluctance to permit me access was palpable.

The on-the-road research was conducted from the pillion of a BMW R1200 GS motorcycle. Personal medical constraints disallowed the possibility of my driving a motorcycle. Moreover, purchasing such a machine for the duration of my fieldwork was not a feasible option. Fortunately, 'riding pillion' rather than driving allowed me to pay special attention to such crucial facets of my ethnography as physical behaviour and formation riding. While I initially suspected that this arrangement might limit my access and acceptance by the group, I found no limitations ensued[10].

2.3.3 Procedures I: Finding the participants and interviewing

Identifying potential interview participants and recruiting them for this research was considerably simpler than I anticipated when designing the study. Many motorcyclists in Costa Rica were amenable to my project, and the overwhelming majority found the interview itself to be interesting and thus were engaging, loquacious discussants. Here I summarize the procedures I employed in discerning, contacting, and recruiting potential participants, and finally in interviewing those interested.

Before leaving Edinburgh, I surveyed all available information accessible through the Internet. Namely, I identified websites belonging to motorcycle groups in the San José metropolitan area. Having done so, I retrieved the contact details for group presidents, leaders, primary organizers, and so forth, whose responsibility it is to coordinate the group. This initial foray into Costa Rican motorcycling yielded 8 groups website, of which 6 are represented in my final sample.

Crucially, this review of websites supplied me with a list of important figures in Costa Rican motorcycling; these 'gatekeepers' proved invaluable in garnering potential interview participants, as well as general information on motorcycling. They assisted me in developing

[10] In fact, my ability to synchronize my bodily movements successfully with the driver provided me with some social capital amongst the members of the group. See Chapter Seven and Schyfter, 2008 for discussions of physical practice and group membership.

links with other group leaders—such as one more group president, head of Costa Rica's oldest motorcycling organization. These participants rendered useful information not otherwise accessible, including data on group rules and regulations; their most valuable contribution to the study, however, came in the form of access to the membership.

Having established contact with prominent members of various groups, I employed a 'snowball' approach in order to recruit more interview participants. Oftentimes, the motorcyclists I interviewed volunteered names and phone numbers of friends and acquaintances they considered amenable to the study. With each interview, my pool of potential participants increased considerably. This form of recruitment yielded a broad sample of participants, as trans-group friendships and collaborations are common within the Costa Rican motorcycling community. Using this approach also contributed one significant benefit; by cross-referencing suggested names, I discerned notable figures in Costa Rican motorcycling. For instance, participants CR-13 and CR-24 are both icons across the spectrum of riders in the country, having started many of the earlier groups and laying the foundation for the myriad organizations now active in Costa Rica.

My primary methods for contacting potential interview participants were e-mails and telephone calls. By way of introducing the project, I initially summarized the broad aims of the empirical research and the themes I intended to address during the interview itself. Scheduling was a function of availability and convenience.

The location for each interview was likewise determined after a consideration of the participant's availability and chosen to maximize his/her convenience. As a result, the interviews occurred in many different settings, including my home, the participants' homes, outdoor cafes, offices, and even a McDonald's eatery. I do not believe that the various settings substantially altered the content of each interview. However, those interviews I conducted at the participants' homes proved particularly valuable, as I was given the chance to see the machine, and observe the driver interact with the motorcycle as he/she introduced me to the artefact. The interviews ranged in length, with a maximum of 84 minutes, a minimum of 21 minutes, and an average length of 50 minutes. Length varied due to such pragmatic variables as scheduling constraints, although the central cause for difference in length was the willingness of each participant to discuss my questions; in several instances, participants had little to say regarding questions that others discussed expansively.

Before commencing each interview, I described the project to the participant in detail. I emphasized the confidentiality and anonymity required of me by ethical protocols, and asked for consent to conduct and record the interview. I explained that the participant was entitled to refuse to answer any question for any reason, as well as to review the transcript at any time. Finally, I informed the participant that I would take notes during the interview as a guide for future reviewing. During the interview itself, I interrupted only to probe further into significant points or steer the conversation back toward the topic under discussion; because the majority of the questions were open-ended, my interjections were rare. My attention was dedicated to listening and recording important comments and ideas onto my notebook. Once my questions were exhausted, I asked the participant to contribute any further thoughts, as well as suggest any improvements that could be made. I finished the session by asking the participant to contact me with any questions, thoughts, or concerns.

The interview questions focused on the relationship between the user and the artefact, the user and the collective, the artefact and the collective, and various aspects of social life in motorcycling groups. The interviews produced a number of surprising results; most notably, the ubiquity of age as a topic of discussion was wholly unexpected, and now forms one third of my empirical discussion. Moreover, the extent to which the participants discussed the senses as components of the riding experience was not anticipated, and the topic is a central facet of Chapter Six.

2.3.4 Procedures II: Transcribing and analyzing

The interviews were transcribed over the course of several weeks. In order to remain faithful to the interviews and simplify the process, I transcribed the audio files but *did not translate them* from Spanish to English. The quotations in this thesis were translated as needed.

My analysis of the transcripts occurred in two stages. First, I read the transcripts several times in order to acquaint myself with the broad, salient points. I then examined each interview transcript methodically in order to identify the nuances from each session. In doing so, I noted important issues I believed to be relevant to the research topic and the aims of this project.

I approached the interview data in accordance with the performative theories of knowledge with which I engage and further develop. Although I did not employ any formal method of

discourse analysis, I considered the responses as utterances made enunciable in relation to specific, identifiable discursive formations (see Foucault, 1972 [1969]). Moreover, I looked to the use of concepts and terms as discrete acts of classification and concept application—fundamentally important to my Strong Programme analysis and my understanding of artefact, subject, and body ontologies. Thus, the responses were representative of social orders and distributions of knowledge, and I conceptualized them as continuous acts of classification, a topic I discuss in Chapter Three.

For the second stage of my analysis, I returned to the transcripts and began to induct primary, secondary (sub-primary), and tertiary (sub-secondary) themes from the notes I took in order to compile an indexation of themes and quotations—included here as Appendix D. This indexation finally took the form of an outline consisting of 8 sections, 37 primary themes, 109 secondary themes, and 264 tertiary themes. Secondary and tertiary themes were each associated with a set of quotations representing sections of the transcripts during which those themes appear explicitly. In total, I identified 1,143 relevant quotations. I chose particular themes for the indexation based primarily on their preponderance throughout the interviews, but my thematic analysis was also informed by my central empirical interests—gender and sexuality, age and ageing, and embodiment, which constitute the empirical modules of Chapters Four, Five, and Six, respectively.

The ethnographic work first took the form of field notes, which I used to document any and all incidents relevant to the study. Upon returning home, I expanded those notes into larger accounts of the day's events, and included throughout these a tentative analytic narrative—pointing out connections to the interviews, the themes, and my theoretical work. Most of the data I collected from my time with the BMW Motorclub addresses issues of embodiment and the practical concerns of group riding. While this work aided the thesis in its own right, its most significant contribution to my analysis was providing me with the experience necessary to comprehend many of my participants' accounts of riding a motorcycle.

2.4 The sample

The final sample of interview participants consists of 36 motorcyclists[11]. The original research design called for a total of 40 interviews, but this goal was modified during the fieldwork for a series of reasons. Most notably, upon completing 36 interviews, I reached a

[11] See Appendix A for a guide to the participants.

saturation point, with little incentive to continue gathering redundant data. I chose to employ the final four interviews to supplant my data on specific groups of motorcyclists; namely, I intended to pursue interviews with speed and off-road motorcyclists, and members of Soldiers for Christ (*Soldados de Jesús*), a religious motorcycling group. Having scheduled interviews 37 and 38 accordingly, both participants failed to arrive for the session; additionally, I was unable to contact Soldiers for Christ, as the organization's president—the single contact person for the group—was outside Costa Rica during the period of my fieldwork. In order to make best use of the remaining time, I ended the interview cycle and focused instead on participatory observation, which until then had not kept pace with my interview research.

In order to describe comprehensively my research sample, this section is divided into five modules: sex, age, income level and profession, motorcycle brand and type, and group affiliation. Each explores the makeup of the sample in relation to the particular descriptor, and includes a discussion of methodological difficulties and benefits.

2.4.1 Sex

Initially, my research design called for interviews with only male participants, given my investigative emphasis on masculinities and technological artefacts. Once I honed the details of my fieldwork and devised a protocol for my research on ontologies, I reconsidered my earlier exclusion of women from the participant sample. Among multiple reasons for this strategic decision were: the relational character of gender, an increasing concern with heteronormativity, a nascent interest in sexuality as interactional knowledge and practice, and an intent on more fully mapping the dynamics of gender and technology. Ultimately, my inclusion of women participants enriched the empirical data, the theoretical argument, and expanded the range of topics address by this research.

In total, I interviewed 27 men and 9 women. Although there clearly exists a numerical disparity between male and female participation, the total number of women with whom I conducted interviews significantly over-represents the participation by women in motorcycling in Costa Rica[12]. Women make up a marginal percentage of licensed

[12] This claim I draw from the interviews. I carried out extensive efforts to obtain official statistics from Costa Rica's Ministry of Public Works and Transport to no avail. Although my request for data on motorcycling licences was sent in the early autumn of 2008 and followed by several reminders, I have yet to receive any statistics.

motorcyclists in Costa Rica, and a visibly low proportion of members in organized motorcycling groups[13]. Nevertheless, over-representing the female population yields a number of benefits, both methodologically and analytically. With an increased number of female participants, I was able to address questions concerning femininities, masculinities, and sexuality more capably. Moreover, the inclusion of women garnered other benefits linked with accessing different motorcycle types, groups, and patterns of usage.

2.4.2 Age

The men and women I interviewed ranged in age from 21 to 60. As with all facets of the sample, I attempted to incorporate a diversity of ages in my study. Despite my success in identifying and enrolling participants from a range of ages, I was unable to avoid a concentration of motorcyclists in their mid-40s to mid-50s. Various causes can account for this convergence of participants, which yielded drawbacks as well as benefits.

One primary discriminator with regard to age in motorcycling is the high cost associated with purchasing and maintaining a motorcycle. Due to levies, high-performance machines of the kind driven by Costa Rica's leisure motorcyclists are prohibitively expensive for many would-be drivers. While many enthusiasts borrow the sum in the form of loans, this first obstacle often proves to be too high an impasse. The influx of lower-cost machines (such as scooters or East-Asian 'copycat' motorcycles) has begun to alter this landscape, but the cost of buying a new motorcycle is still a significant disincentive. Consequently, many of my interview participants are individuals capable of mustering sufficient private wealth to purchase these machines. Individuals in their late 40s and early 50s, who have been working for several decades, can afford to spend more money than their younger colleagues, who may lack a steady income and sufficient savings.

Additionally, it is possible to identify family factors that influence the distribution of age. Interview participants in their 30s generally commented that their energies and commitments were dedicated to their families. As parents, many felt a responsibility to sacrifice their own leisure for the benefit of their children. Similarly, many older participants noted that the later period of their lives was a time of 'justified selfishness'[14], during which they could engage in activities otherwise viewed as irresponsible. For adolescent riders, the difficulty is different,

[13] For a report on changing patterns of motorcycle ownership by sex, see Krauss, 2007.
[14] This term I draw from the interviews. While it may be self-effacing, it is not pejorative.

as the dangers commonly associated with driving motorcycles make it challenging to convince parents to contribute monetarily for such a machine.

Finally, it is possible to postulate that older participants are absent due to the physical requirements of riding motorcycles. This form of embodied experience is one articulated by many of the older participants of my study, who expect their bodies to encounter difficulties in riding. Often, this phenomenon influences the type of motorcycle ridden, as I detail in Chapter Six.

2.4.3 Income level and profession

Many of the factors delimitating my sample in relation to age have similar consequences with regard to income level. The most significant constraint upon ownership of high-performance motorcycles is a financial one; as such, economic class is an ever-present component of motorcycle culture in Costa Rica.

This study's participants represent a spectrum of income levels and professions. Like age, there exists a concentration. Many of the participants belong to the upper-middle and upper economic classes with regard to income and profession. Additionally, most of the participants had received some form of tertiary education. Finally, many had worked or are currently working in managerial capacities for large corporations. A number of the participants were working-class individuals, although these were unquestionably exceptional. In designating participants as belonging to a specific economic class, I followed their own categorization; that is, within the empirical study, economic class is a participants' schema.

It is possible again to fault the high premiums required to participate in motorcycling as the root cause of this disparity, and the cost of motorcycles in Costa Rica is undoubtedly centrally involved in the makeup of the sample. However, there exist other causes—particularly some methodological ones—of which this skewed distribution is a function. Given the 'snowball' approach used to garner participants, some homogeneity was to be expected from a segment of the sample; many of the motorcycle groups tend toward fairly uniform composition. Those groups that incorporate a broad representation of motorcyclists were difficult to contact and approach for interviews. Moreover, I aimed to interview drivers of a range of motorcycle brands and types. Accordingly, I contacted drivers that owned

BWM and Harley-Davidson motorcycles—to name two examples—in order to satisfy specific quotas for these makes. These brands, along with others, including KTM and Aprilia, are considerably more expensive than those manufactured by companies such as Honda or Suzuki. Finally, my choice of group to observe—the BMW Motorclub—clearly influenced the income level distribution of the motorcyclists I studied in participant observation. These methodological choices, along with the financial reality of motorcycling costs, resulted in this makeup of my sample.

2.4.4 Motorcycle brand and type

A central aim of my research design was to incorporate as broad a sample of motorcycle types and brands as possible in order to assess issues of machinic differentiation. With regard to this goal, the sample successfully represents a variety of machines.

Drawing precise delineations between types of motorcycles is not an intention of this work, and no form of strict typology informs my analysis of this technology outside the dynamic taxonomies articulated by each community. However, for the purposes of this methodological review I can classify the machines included in the 36 interviews carried out. The largest group of motorcycles represented consists of BMW double-purpose machines, a unique category that comprises both a maker and a type. The second largest group is that of generic cruisers, slower-driving machines typically associated with the Hell's Angels stereotype of gang motorcyclists (see Thompson, 1999 [1966]). I consider Harley-Davidson cruisers separately for analytic reasons. Fourth, I studied choppers, which while similar to cruisers, differ materially and sociologically. Fifth, I interviewed a handful of drivers of enduro, or off-road, motorcycles. I conducted a number of interviews with speed motorcyclists, whose machines are also referred to as sportsbikes or superbikes. A handful of interview participants owned scooters in addition to their primary motorcycles, and one drove no other machine. Eighth, I interviewed several drivers of standard bikes, also referred to as naked bikes. I conducted one interview each with an owner of a sport touring and a touring motorcycle, designed for long-distance travel but differing from each other significantly. Last, I carried out a single interview with a courier motorcyclist, whose low-cost machine is designed for fast, inner-city travel. Images of each motorcycle are included as Appendix B.

Additionally, I interviewed two former professional motorcycle drivers. The first competed in motocross events, while the second raced in speed competitions. These two participants drove a number of different machines, including some not available to general consumers.

2.4.5 Group affiliation

Finally, I interviewed motorcyclists from many organizations. The aim was to learn about collectivity and conventionality by studying the agent-collective relationship across a number of varying cases. In this, as in the breadth of machine types studied, I succeeded in accruing a satisfactorily broad representation of group affiliation.

I interviewed members of two brand-exclusive groups, the BMW Motorclub (*BMW Moto Club*) and the Harley Owner's Group, or H.O.G., both of which require the purchase of a particular make as the initial basis for membership. I studied two type-specific clubs, Steel Angels and Tico Superbikes[15]; the members of these groups were required or strongly encouraged to own a cruiser or a sportsbike, respectively. Several participants were members of M14, Coyotes, Falcons (*Halcones*), or ACOMORE (*Asociación Costarricense de Motociclismo Recreativo*[16]), clubs with a broad approach to group membership in relation to machine type. Finally, I interviewed several members of Black Widows (*Viudas Negras*), a women-only group and the only group in Costa Rica with an *explicit* gender requirement for membership. I also conducted research with individuals not involved in group motorcycling—leisure motorcyclists with no organization affiliation, motorcyclists whose use of the machine is limited to transit, professional racers, and a courier.

The groups varied along numerous axes. Although categorized by their most evident differences in my summary above, the groups represent a diversity in terms of organization, exclusivity, worldview, regulations, practices, size, reputation, and collective identities. For instance, both the BMW Motorclub and H.O.G. are well-organized, medium-sized groups with a reputation for exclusivity, but they differ greatly in practices such as clothing and the regularity of trips. Coyotes and ACOMORE are both large organization with no machinic focus, but their reputations are wildly different. Coyotes is reputed by others to be a dangerous, generally low-class group with loose rules and consequently unsafe drivers;

[15] 'Tico' is an affectionate colloquial term for Costa Rican.
[16] Costa Rican Association for Recreational Motorcycling

ACOMORE is a family-oriented and highly-structured club with many regulations, and is as such reputed a conservative organization.

2.5 Empirical data and sociophilosophy

The sociological methods I employed and the resultant empirical data make possible the central sociophilosophical aim of this research—namely, that of assessing the manners and modalities in which artefacts, subjects, and bodies are rendered intelligible. The primary and secondary questions I address and resolve—defined and contextualized in Chapter One—demand empirical substantiation. Consequently, this thesis employs empirical work throughout the analytic and theoretical arguments. Moreover, this volume presents three sections of consolidated case material, each positing a unique and original empirical argument addressing a specific ontological modality. Plainly stated, my empirical strategies and research are invaluable to this work. Nevertheless, my sociophilosophy of artefacts, subjects, and bodies is an analytic and theoretical study. The empirical data is rendered through the Strong Programme, and my study in questioning ontologies is a project in further developing the Performative Theory of Social Institutions.

Chapter Three: The Strong Programme's Performative Theory of Social Institutions

This chapter's discussion of the analytic framework within which my study of ontologies is situated and which my research further develops is a necessary expositional pause. This review recapitulates significant work by David Bloor, Barry Barnes, and Martin Kusch, the primary authors responsible for the development and elaboration of the Performative Theory of Social Institutions (PTSI). Using PTSI, I render a sociophilosophical conceptualization of artefacts, subjects, and bodies as artificial kinds, of their ontologies as social institutions, and of these entities as entangled phenomena requiring symmetrical analysis.

The chapter first explores the Strong Programme in the sociology of scientific knowledge before outlining the substance of PTSI. I then discuss Martin Kusch's elaboration of PTSI and his introduction of the artificial kind—the central analytic tool with which I question artefacts, subjects, and bodies. Finally, I review the epistemic concordance of PTSI and Michel Foucault's and Judith Butler's performative theories of knowledge.

3.1 The Strong Programme in the sociology of scientific knowledge

The Performative Theory of Social Institutions was developed within and is a fundamental component of the Strong Programme in the sociology of scientific knowledge. Some familiarity with the Strong Programme, its central tenets, and ontological, epistemic, and methodological standpoints, is a necessary first step in codifying PTSI.

The Strong Programme, also recognized as the Edinburgh School, is a theoretical and methodological tradition within the sociology of knowledge. Its developers and practitioners aimed at extending the insights of this discipline into the realm of *scientific* knowledge. In establishing the protocols of the Strong Programme, David Bloor identified a "hesitation and pessimism" (Bloor, 1991 [1976]: 3) in engaging with scientific knowledge via sociological analysis, and argued that the root cause of this failure to "bring science within the scope of a thorough-going sociological scrutiny is lack of nerve and will." (Bloor, 1991 [1976]: 4)

Rather than evade scientific knowledge, the Strong Programme engaged directly with science, mathematics, and logic, the latter two generally considered to be the 'hard cases' in the sociology of knowledge[17].

The developers of the Strong Programme—among them David Bloor (1991 [1976]) and Barry Barnes (1977)—sought to apply scientific methods to the sociological analysis of scientific knowledge. The central tenets of the Edinburgh School and the methodology they specify are formulated so as to formalize and apply "the same values which are taken for granted in other scientific disciplines" (Bloor, 1991 [1976]: 7); as such, Bloor considers himself and other developers of the Strong Programme to be inductivists of theory and methodology, transferring and adapting the "instincts we have acquired in the laboratory to the study of knowledge itself." (Bloor, 1981: 206)

Before cataloguing the Strong Programme's four core principles, prior consideration must be given to fundamentals in order to render a faithful account of this research tradition. I do so in order to contextualize PTSI within broad ontological and epistemological debates. Scholars working within the Strong Programme subscribe to ontological realism[18]; that is, this tradition recognizes the existence and importance of a material world 'out there'[19]:

> No consistent sociology could ever present knowledge as a fantasy unconnected with our experiences of the material world around us. We cannot live in a dream world. (Bloor, 1991 [1976]: 33)

However, this material world does not stand in a deterministic relationship with our knowledge about it[20]; empirical phenomena always underdetermine knowledge (Quine, 1964 and 1975; see also Pinch, 1985).

The underdetermination of knowledge by empirical observation fundamentally influences the Strong Programme's epistemology. Scientific knowledge—like all forms of knowledge—is a product of collective human practice, and transcends direct empirical experience[21] through social processes such as negotiation and consensus (Bloor, 1991

[17] See Mulkay, 1979 for some background.
[18] I discuss the ramifications of realism in sections 7.4 and 8.2.
[19] Rafanell discusses other implications of this ontological stance (2003).
[20] N.B.: The Strong Programme *does not seek to analyze this world*, but rather knowledge *about* this world.
[21] See Kusch's discussion of 'direct realism' (2002: 102-105).

[1976]). Thus, the Strong Programme's epistemology[22] is that of the gregarious: knowledge is what the collective takes to be knowledge (Barnes, 1981a; Bloor, 1997b; Kusch, 2002).

Finally, the Strong Programme's methodology is fundamentally characterized by relativism (Bloor, 1981 and 1999). Crucially, this relativism is a component of the Edinburgh School's methodology, and *not* its epistemology nor its ontology, setting it apart from other research traditions within science studies and the sociology of knowledge (c.f. Latour, 1993)[23].

Having established the philosophical foundations of the Strong Programme, I can address the four tenets, or principles, that underlie and uniquely distinguish this research tradition (Bloor, 1991 [1976]). The Strong Programme is *causal*, in that it seeks to identify the underlying causes, social and otherwise, for particular knowledge claims[24]. The Strong Programme is *impartial* to "truth and falsity, rationality or irrationality, success or failure" (Bloor, 1991 [1976]: 7) insofar as both components of these dichotomies demand satisfactory sociological explanation. Present conventional beliefs regarding any body of scientific knowledge cannot influence the processes of investigation and analysis. The Strong Programme is *symmetric*, in that any account of the development of scientific knowledge claims must employ the same causal explanations for true and false beliefs. True knowledge claims do not come into existence by virtue of their truth, nor do false beliefs come into existence by virtue of 'social interference' or 'cultural noise'. Finally, the Strong Programme is *reflexive*, in that it must be capable of rendering causal, impartial, and symmetric accounts of knowledge claims produced by sociology itself[25].

These four principles—causality, impartiality, symmetry, and reflexivity—constitute the foundation of the Strong Programme in the sociology of scientific knowledge, although it has been symmetry, more than the other three, that has characterized the Edinburgh School within STS, as well as drawn critiques for its underlying methodological relativism (see e.g. Kemp, 2005; Latour, 1993; Laudan, 1981). Space here does not allow for an exhaustive account of these debates, but I provide a discussion in sub-section 7.4.3.

[22] The Strong Programme's epistemology is referred to as collectivist (Rafanell, 2002) or communitarian (Kusch, 2002). I use the latter term.
[23] See also Bloor, 1999a and 1999b, Latour, 1999a.
[24] This first principle is linked to a concern with interests (c.f. Barnes, 1977).
[25] To negate reflexivity would be to refute the very project of the Strong Programme.

My study of ontologies, though not properly in the sociology of scientific knowledge, nevertheless draws uniquely upon these tenets. This study is causal insofar as I aim to identify the social manners that underlie the constitution of particular ontological modalities of artefacts, subjects, and bodies. More importantly, it is symmetrical, in that I aim to develop an equal explanation of artefact, subject, and body ontologies; this facet of my work is discussed in detail throughout Chapter Seven, and is reflected in the analytic congruency of Chapters Four, Five, and Six.

3.2 The Performative Theory of Social Institutions (PTSI)

The social theory underlying the Strong Programme can be referred to as the Performative Theory of Social Institutions. Unlike the tenets of the Strong Programme, the constitutive elements of PTSI were not explicitly and jointly codified; rather, these theoretical tools were developed over a period of time and a range of publications. Moreover, though ultimately rooted in the Edinburgh School, PTSI achieves rather different aims and explanatory potentials than the former; while born of the Strong Programme, PTSI extends beyond it.

This summary progressively incorporates individual elements of PTSI into a coherent whole. Although separated in this text, each module of the theory is necessarily situated within the rest; this theoretical reticulation is evident once wider themes are addressed. By moving from fundamentals to broad implications, I first demonstrate the mechanics of the theory and then its repercussions.

3.2.1 Classification and concept application

The Performative Theory of Social Institutions is fundamentally a social theory of knowledge and cognition. The first articulations of PTSI address classification and concept application as key social phenomena (Barnes, 1981a and 1983; Bloor, 1982)[26]. Barry Barnes begins his social analysis of concept application by dichotomizing terms into two idealized categories—representing extremes along a continuum—that operate in opposite manners. Barnes' examination of natural-kind (N-kind) and social-kind (S-kind) terms is the foundational work of PTSI.

[26] For more on classification and social life, see Bowker & Leigh Star, 2000.

Natural-kind terms are those applied through a process of perception and pattern-matching whereby empirical qualities are employed to discriminate between various potential terms. That is, N-kind terms are applied by reference to a set of empirically-verifiable characteristics; these qualities are perceptually collected and then cognitively matched to a stored pattern[27]. An agent might empirically observe that a particular entity displays qualities associated with other objects previously referred to as 'leaves'. In this instance:

> The empirical characteristics of a putative leaf are then sufficient to decide whether or not it matches the pattern. The agent's being automatically struck with the fact that such and such is a leaf is a matter of his perceptual and cognitive apparatus carrying through some routinized, habituated, pattern-matching procedure. (Barnes, 1983: 525)

The agent—once trained and competent in the relevant concepts (see Barnes, 1982)—needs only to assess the empirical qualities of the object to ascertain the appropriate term to be employed. Referential practice is dependent upon empirical perception[28].

Because of this dependency upon empirical properties, it is possible to identify some critical repercussions of N-kind terms. Note that the referent, the spatio-temporal entity to which we apply the term 'leaf', exists independently of the referential practice and the nominal term. The object would continue to exist were the agent or the community to suddenly apply to it the term 'duck' or 'cloud'. Our choice of term and our referential practice are ultimately irrelevant in considering the entity's ontology: the referent does not vanish with the cessation of referential practice. As such, N-kind terms are *alter-referential* (Kusch, 1997).

Barnes' second idealization is the social-kind term. By definition, S-kind terms involve no pattern-recognition of the form involved in the usage of N-kind terms; S-kind terms "must be applied to particulars without any appraisal at all of their empirical characteristics." (Barnes, 1983: 525) Consider the term 'authority'. Which agent, amongst a community, is possessive of 'authority' cannot be determined by virtue of empirical examination; no physical characteristics will serve to discriminate the possessor of 'authority' from others in the collective[29]. Rather, the term is applied on the basis that it has been applied correctly in the

[27] For more on similarity relations, see Barnes, 1982 and Hesse, 1974.
[28] See Kripke, 1980 [1972] (esp. Lecture III) for a discussion of natural kinds, physical properties, and naming.
[29] This is not to suggest that material *representations* of 'authority' do not exist—for instance, uniforms. However, the semiotic or representative capability of such material indicators is premised on the social-kind, making them self-referential as well. Uniforms or physical representations of 'authority' are artificial kinds, which I discuss in section 3.3. Moreover, other physical indicators of

past; an agent has 'authority' because the collective has previously referred to the agent as having 'authority'.

As no empirical observation is involved in the process of applying a social-kind term, no spatio-temporal referent exists. This results in several important consequences. First, no N-kind mechanism of pattern-recognition and comparison exists for S-kind terms, as the term applied is precisely what distinguishes the particular in the first place. The pattern recognized is the term applied. As such, social-kind terms are *self-validating*. Furthermore, no referent exists independently of reference. Without reference to an agent possessing 'authority', that 'authority' has no meaningful existence. Referential practice creates the referent it labels. Social-kind terms as thus *self-referential* (Barnes, 1983; Kusch, 1997).

Much of PTSI grows from this final observation, and self-referentiality is a cornerstone of the Strong Programme's social theory—as it is for the works of Michel Foucault (2006 [1966] and 1972 [1969]) and Judith Butler (1988 and 1999 [1990]). Consequently, it is imperative to address self-referentiality and its implications for social theory vis-à-vis performativity.

3.2.2 Self-referentiality and performativity

Social-kind terms are self-referential; the practice of reference is responsible for the creation of the referent, which otherwise has no independent existence. It is upon this set of fundamental tenets that Barnes argues for a performative conceptualization of knowledge and cognition, grounded in the realist ontology of the Strong Programme.

Consider a single, isolated agent employing an S-kind term. This is a confounding phenomenon, and although Barnes argues that it provides little in the way of sociological significance (1983), a careful examination yields some necessary preliminary observations. The first is of course the self-referential nature of S-kind terms, although in this instance this seems to raise more problems than it resolves. The fundamental difficulty associated with all such terms is origin; with no empirical basis upon which to establish a point of initiation, an isolated agent can employ an S-kind term convincingly only in one of two circumstances.

'authority'—such as physical practice—certainly exist (e.g. salutes). Nevertheless, these are similarly rendered as signifiers through self-referential practice. See Chapter Six and Collins & Kusch, 1998.

First, it is possible to hypothesize that the S-kind term has always existed, and thus avoid engaging with the question of origin[30]. This approach renders no new information, and is the implicit argument taken hitherto. Hypothesizing an ever-present S-kind term is no solution; it is an avoidance of the question.

It is also possible to conceive of an isolated agent as an all-powerful initiating mechanism that creates the S-kind term from nothingness and thus *primes* the cycle of self-referentiality. Any agent capable of doing so carries out an ideal performative utterance (see Austin, 1965). Such ideal acts do not exist, as all referential practice is in some fashion or other circumscribed by limitations, be they social, cultural, natural, or technological. However, by analyzing the idealization, it is possible to understand all S-kind terms as fundamentally performative, and thus this social theory of knowledge and cognition finds epistemic congruency with the works of Foucault (2006 [1966] and 1972 [1969]), and Butler (1988 and 1999 [1990]).

Despite this observation, an examination of isolated agents is limited by the S-kind term's inescapably tautological character ('X is S because X is S'). However, what is unavoidable in isolation becomes advantageous in gregariousness. The critical transition is one from single agents to a system of interacting agents; the potential of PTSI is clear only when the analysis moves from the singular to the collective[31].

3.2.3 Collectives and bootstrapping

The communitarian epistemology of PTSI underscores a paramount tenet of this theoretical framework: that individual practice is a product of collective social interaction. The S-kind term—so limited when considered individually—achieves its complete analytic potential when considered as a function of collective knowledge production.

A community, or collective, of agents resolves many of the earlier difficulties with self-referential concept application; furthermore, such a distribution provides key theoretical insights to my examination of knowledge and the social order. Consider a community of agents. Each individual act of reference in a collective is a component of a broader

[30] Such an approach is advocated by Michel Foucault (see Foucault, 1977 and Nietzsche 1989a [1886] and 1989b [1887]).
[31] See Wittgenstein, 2001 [1953] on private language. This concept is of paramount importance to the Strong Programme's position on the issue.

circulation of referents and references. One fundamental problem identified earlier is resolved by this arrangement. Unlike N-kind terms, S-kind terms have no empirical, spatio-temporal entity against which referential acts function. This self-referential character of S-kind terms proves difficult when considering a single agent. However, any agent within a community can draw upon the referential practice of other agents. In using the term 'authority', I draw upon others' uses of the term as my referent, and they do the same[32]. Collectively, we sustain the S-kind term.

Each individual agent is a component in the makeup of the collective, just as the collective is necessary for the continued functioning of each agent's referential practice. Barnes refers to such systems of agents as *bootstraps*, and to S-kind terms in this situation as *bootstrapped*:

> …whenever in a system of inductive inferences the products emerge tagged with patterns recognized earlier in the system the intervening inductions will be described as *bootstrapped*. (Barnes, 1983: 534, my emphasis)

Bootstrapped induction is at the core of PTSI, and its repercussions are significant for analyses of social interaction.

Bootstraps are products of collective social practice; the operation of the system as a whole, as well as the individual inductive functioning of single agents, requires an integrated performance. Writes Barnes:

> Individual inductions concern the operation of the array itself…[p]ersons individually learning, and confirming what they learn, collectively create its reference. (Barnes, 1983: 533)

Without the system, S-kind terms have no meaningful stability; within the collective, consensus breeds stability.

A fundamental repercussion of bootstraps is their reification through expansion and the perceived fixity of extensive tautological systems. With ever-increasing participation, bootstraps become more immutable and less problematic for individual members (Kusch, 1999); with stability comes reification. As Barnes argues:

[32] See Kripke, 1980 [1972] for the importance of collectively-sustained referents and the act of naming.

> Where an array is truly large… individual calculation may have imperceptible effects on the pattern of which it is part. The pattern may then be conceptualized, without immediate harm, as a fixed entity within which straightforward inductive inferences are made… (Barnes, 1983: 536)

Large, even society-wide, bootstraps are not simply ubiquitous, but fundamentally necessary for the effective operation of social interaction; consider the roles fulfilled by any form of categorization (Barnes, 1981a; Foucault, 2006 [1966]) or our tacit acquiescence to such institutions as banking and currency (Barnes, 1983). These bootstraps are effectively reified, and benefit from an individual's sense that they have 'always been there'[33].

Barnes' concept of bootstrapped induction also furthers the sociologist's understanding of temporality and the development and evolution of social phenomena. Any self-referential system requires some form of priming in order to be plausible. The history of a bootstrap's priming, development, and evolution are powerful tools in the investigation of a society[34]. While it is conceivable that a bootstrap may be initiated by a single or oligarchic authority—as may be the case with particularly influential agents or groups (Barnes, 1988)—it is more plausible that social phenomena of this form develop gradually over long spans of time. An example of the first case might be short-term fashion trends, which are initiated by influential and authoritative figures; an example of the second is currency, the origins and evolution of which are elusive, progressive, and protracted. Significantly, for those embedded within the bootstrap, "the initial designations carried by particulars are simply 'there' in the pre-existing social context" (Barnes, 1983: 532), while scrutiny reveals the problematic and historically-contingent nature of these designations.

Bootstraps, although fundamentally performative and self-referential, exist as effectively 'real' entities in social systems. In the everyday transactions of a society, few individuals not otherwise engaged in philosophical discussions question the 'reality' of money, an exemplary case of self-referentiality. The single agent operates as if inferring from an existing, immutable reality[35]. The place of the individual within a massive self-referential

[33] "What we call the world of objective meaning is, therefore, abstracted in the social sphere from the constituting processes of a meaning-endowing consciousness, be this one's own or another's. This results in the anonymous character of the meaning-content predicated of it and also its invariance with respect to every consciousness which has given it meaning through its own intentionality." (Schutz, 1972 [1932]: 37) See also ibid, pp. 74 and 82, on the 'taken for granted'.
[34] See Foucault, 1977 on 'effective history'.
[35] Put otherwise, the referent is 'de-historicized': "Tradition takes what has come down to us and delivers it over to self-evidence; it blocks our access to those primordial 'sources' from which the

system is such that the contingent and performative character of the institution is not manifest.

A bootstrapped S-kind term can also be referred to as a *social institution*[36], and I employ this term hereafter. Social institutions are characterized as possessing five primary properties:

Social institutions are *conventional*, in the sense that they are contingent upon conceptual frameworks that exist within specific spatial, temporal, and cultural contexts.

Social institutions are *self-referential*, insofar as reference to the institution is not reference to a spatio-temporal referent.

Social institutions are *performative*, in the sense that the collective brings the referent into existence[37].

Social institutions are *collectively-constituted*, in the sense that they are created and sustained through the practices of a multitude rather than isolated individuals.

Social institutions are *normative.* Institutions are susceptible to normative judgments, and agents within them display practices of sanctioning, imitation, and self-correction. This property of institutions is addressed more fully below.

Thus far, the properties of knowledge and cognition examined emphasize the collective foundation of all forms of knowledge. This is the paramount principle of PTSI, as well as its central epistemic claim. In order to elaborate upon this examination of collectivity, it is advisable to explore the manner in which individual instances of knowledge usage occur. That is, having covered the dynamics of the collective, it is necessary to gauge the repercussions of these upon individual agents, and upon individual instances of knowledge usage. To do so is to engage with finitism.

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categories and concepts handed down to us have been in part quite genuinely drawn." (Heidegger, 2005 [1927]: 43)

[36] The term 'social institution' is used by the Strong Programme in a manner congruent with Durkheim (c.f. Bloor, 1982) and Wittgenstein (c.f. Bloor, 1997b).

[37] There also exists a dialectic insofar as communities can generate and can be generated by institutions. I consider this topic throughout the thesis.

3.2.4 Finitism

The Strong Programme in the sociology of scientific knowledge—and consequently PTSI—subscribe to a *finitist* understanding of knowledge. Finitism is best understood in relation to the above concern with concept application. Meaning finitism is a philosophical tenet that places social interaction at the core of concept meaning, and emphasizes the continual, dynamic re-production of meaning through iteration and collective consensus (Barnes, Bloor, & Henry, 1996; Bloor, 1997b)[38].

According to meaning finitism, meaning does not precede usage, but is rather a function of usage (Bloor, 1997b; Wittgenstein, 2001 [1953]). An agent will not use a term because the meaning of the term somehow compels that agent to use it in one way or another. Instead, it is the usage of the term that provides the term with meaning. The concept 'leaf' has no meaning in and of itself; it is through referential practice that 'leaf' comes to possess meaning. As such, meaning is constructed on a case-by-case basis.

Meaning itself is itself not possessive of agency; it cannot constrain or compel[39]. The true constraint for any usage of a concept is *social* constraint, and while empirical constraints are important, they are not determinant of the usage of any term:

> Each and every instance of concept application takes place under the impact of local contingencies… [such as] traditions, precedents, authorities, goals and interests. The fit of our concept to reality is, therefore, not just a matter for reality; it is always a matter (collectively) for the concept user as well. (Bloor, 1996: 853)

What can be accepted as 'correct' or 'incorrect' usage of any particular concept is a judgement carried through at the collective level; meaning is a collective good, produced through and sustained by social interaction.

This basic formulation—meaning follows use and use is not determined by meaning—is the foundation upon which finitism is constructed. This proposition carries with it a series of critical repercussions, which taken together constitute the central principles of finitism (Barnes, Bloor, & Henry, 1996: 54-59):

[38] For a debate concerning Wittgenstein and finitism in science studies, see Lynch, 1992a and 1992b and Bloor, 1992.
[39] See Durkheim, 1982 [1895].

All future applications of terms are open-ended. Meaning finitism is based on the notion that ostension is at the basis of concept learning (Barnes, 1981a). Once the learner has a grasp of the concept, future usages of the term are based on analogizing from a finite set of exemplars[40]. Thus, each new instance of classification is sociologically problematic. Meaning is not fixed, but is rather a product of each new instance of concept application. Nothing outside of social interaction prevents new, different uses of any term.

No act of classification is always indefeasibly correct. This point is an extension of the former. As meaning is not fixed, and all acts of classification are processes of analogy, no single act of concept application can be deemed unquestionably and ineffably correct. Just as meaning is always underdetermined by the empirical, so there exists no absolute standard of 'correctness' against which to judge acts of classification. What is 'correct' is what the collective takes to be 'correct' and any act of classification is always vulnerable to sanctioning.

All acts of classification are revisable. Just as future acts of classification are not determined, and any act of classification can be challenged on its 'correctness', so previous instances of concept application, as well as previous models, patterns, and paradigms, can be re-assessed. This tenet emphasizes an important sociological point concerning temporality; following finitism, "the authority of collective judgement extends across the whole of time." (Barnes, Bloor, & Henry, 1996: 57)

Successive applications of a kind term are not independent. Meaning is a function of usage, and usage is a function of previous instances of usage. Whenever a concept is applied, a new exemplar is added to the set against which new particulars are matched. Each instance of classification revises the pattern with which future acts will operate, and thus no future usage of a term will be independent from previous usages.

Applications of different kinds of terms are not independent from each other. Any system of classification consists of a set of different concepts linked together and ordered against one another. Competent members of a particular system of classification are so because they are

[40] For more on analogy, see Hesse, 1959.

deft in the usage of the entire system, not simply one term. When the pattern corresponding to one concept changes, so do those of other closely-linked concepts[41].

These fundamentals of finitism rely on an understanding of knowledge as collective practice, and of specific knowledge claims as iteratively established and maintained. The ontologies I am questioning here are similarly constituted—through repetition and in concordance with the tenets of finitism. A full discussion of the concept of underdetermination—and its relevance to finitism and my sociophilosophy—is included in Chapter Four and further discussed in Appendix E.

3.2.5 Mutual susceptibility, sanctioning, and normativity

The most salient—and the most important—facet of PTSI is its emphasis on collectivity. Barnes' and Bloor's works include a forthright commitment to sociological explication, as does this thesis. Human beings engaged with others in social practice must be understood as such, as gregarious agents positioned in intersubjective relations (Barnes, 1995). Barnes states:

> …human beings cannot be understood as independent calculative individuals; they stand revealed in their practice as profoundly interdependent, mutually susceptible social agents. (Barnes, 2001b: 26)

Individual practice is—within PTSI—a concern insofar as it constitutes and is itself influenced by collective activity (Rafanell, 2002). The researcher cannot disregard the actions of single agents when considering the aggregate any more than the collective can be elided when examining the activity of single agents. Once more, writes Barnes:

> It is only though the interaction of a membership characterized by mutual intelligibility and mutual susceptibility that something identifiable as shared practice can be sustained. (Barnes, 2001b: 26)

Mutual susceptibility is a fundamental criterion for the existence of any social institution—such as a language (Wittgenstein, 2001 [1953]) or a rule (Bloor, 1997b)—and for the success of any performative utterance (Austin, 1965) or practice (Barnes, 2001b).

[41] This is critically important to my central thesis. See Chapter Seven.

Moreover, mutual susceptibility is important for its role in communal normativity. Normativity plays a central role in maintaining the integrity of social institutions by attenuating individual idiosyncrasy and superordinating adherence to collective standards. Otherwise put:

> … the successful execution of routines at the collective level will involve the overriding and modification of routines at the individual level. (Barnes, 2001b: 23)

Agents in communities sanction incorrect practices and self-correct when sanctioned themselves. Communal consensus establishes the standard to be maintained and sanctioning reinforces that standard (Kusch, 1999). Consequently, normativity is productive, not simply repressive; sanctioning mechanisms and self-correction are responsible for coherence. Much of Barnes' work is dedicated to 'status groups', collectives of agents wherein practices of inclusion and exclusion continuously perform communal boundaries, and establish and maintain group norms (Barnes, 1992 and 1995).

The importance of mutual susceptibility and normativity underscores a number of difficulties with PTSI. First, communities are not homogeneous, and not all agents are equally susceptible to sanctioning. Barnes' and Bloor's accounts of collectives simplify complex group dynamics and posit agents as identically receptive to social interaction; empirically, such homogeneity does not exist. Importantly, power differentials permeate all communities[42], endowing certain agents with more capability to influence other agents. Moreover, relations of susceptibility are vulnerable to temporal change, and social power—as the capacity to define possible practice (Barnes, 1988; Foucault, 1982)—is dynamic. These observations do not render the PTSI account of communities null; rather, they serve to complicate and improve this account.

Second, conformity is not exact, and divergence is not unregulated. Individual idiosyncrasy is ubiquitous, and precise consensus never exists. The notion of communal consensus is an analyst's construct, as single agents always diverge from the community in varying degrees of difference. Nevertheless, sanctioning is real and gradual, omnipresent policing maintains a mutable range of consensus in place.

[42] An important power differential is that between neophyte and teacher. See Barnes, 1982 and Bloor, 1997b.

Third, sanctioning is not infallible, and resistance is possible. Clearly, sanctioning is not unproblematic, and sometimes fails to succeed[43]. Moreover, with every instance of sanctioning, there exists the possibility of resistance. These are fundamental properties of normativity, and betray the heterogeneity of intersubjective practices. In discussing entangled ontologies, I endeavour to illustrate this complexity, identify power and susceptibility differentials, and discuss the fluidity of consensus.

3.3 Kusch and the artificial kind

The third Strong Programme theoretician to feature prominently in this research is Martin Kusch, whose work in sociophilosophy extends and improves several core concepts of PTSI. Along with an improved understanding of self-referentiality, Kusch contributes the central analytic tool within this thesis: the artificial-kind term (1997). It is imperative to explore Kusch's re-conceptualization of self-referentiality and his implementation of artificial-kind terms alongside natural- and social-kind terms.

Barnes defines natural- and social-kind terms based upon the usage of empirical verifiability and pattern recognition. Natural-kind terms are those that display no self-referentiality, but rather refer entirely to obdurate empirical qualities; social-kind terms conversely display only self-referentiality, and involve no consideration of empirical characteristics. Following from Barnes' original definition (1983), Kusch develops an alternative taxonomy of kinds[44]. Unlike Barnes, Kusch argues that both natural- and social-kind terms display some self-referentiality; it is the character of this self-referentiality that distinguishes N- and S-kind terms (Kusch, 1997)[45]. A natural-kind term, such as 'leaf', displays a self-referential component insofar as there exist criteria for classification of entities as leaves; although our reference ultimately points to an existent physical entity, our "models, paradigms, and prototypes" (Kusch, 1997: 17) for classifying the particular are entirely self-referential. Social-kind terms display self-referentiality in an absolute sense; reference to 'authority' refers only to verbal and physical practices[46], which themselves refer back to 'authority'. There is no independent referent outwith referential practice. In N-kind terms, self-reference

[43] An interesting concept here might be Austin's 'conditions of felicity' (1965).
[44] In fact, Kusch develops a taxonomy of kinds, whereas Barnes identifies two ideal extremes along a continuum. The two approaches differ substantially in this regard.
[45] In doing so, Kusch makes problematic the distinction between N- and S-kind terms, allowing for greater dialogue with works such as Haraway's analysis of 'posthumanities' (2008) and Actor-Network Theory's notion of generalized symmetry (Latour, 1993). I discuss the latter in Chapter Seven.
[46] Physical practices are discussed extensively in Chapter Six.

is limited to models of classification; in S-kind terms, self-reference is absolute. In N-kind terms, the particular does not cease to exist with cessation of reference; in S-kind terms, the particular does not exist outside of reference.

Alongside natural- and social-kind terms, Kusch introduces a third category necessitated by this re-definition of Barnes' work: artificial-kind terms. Artificial-kind (A-kind) terms stand between N- and S-kind terms, displaying seemingly contradictory properties. As do N-kind terms, A-kind terms have alter-referents. However, unlike N-kind terms, A-kind referents are dependent upon referential practice for their existence. Put a different way, while artificial-kind referents have empirical qualities that can be observed and analyzed (an alter-referent exists), their ontologies are the product of self-referential activity (their ontologies are social institutions).

Artefacts such as 'motorcycles' have alter-referents in the sense that the spatio-temporal entity has an existence outside referential practices. The specially-shaped pieces of metal, plastic, and leather possess an obdurate existence; it is possible to identify broad prototypical examples of these entities[47]; with the cessation of referential talk, the collection of metal would continue to exist. The assembly of material—strictly as a spatio-temporal entity—has an existence independent of social activity[48]. However, the entity known as a 'motorcycle' (motorcycle *qua* motorcycle) is necessarily dependant on social activity for its ontological status (the property of being-a-motorcycle). This discussion is the topic of Chapter Four, and similar arguments concerning subjects and bodies are the purview of Chapters Five and Six, respectively.

I should here state that while PTSI was initially developed to explore *terms* and *concepts*, I discuss artefacts, subjects, and bodies as *artificial kinds*, not *artificial-kind terms*. While nominative demarcations are of obvious import, I study entities and their ontologies rather than the terms employed in distinguishing between them[49]. My interests lie with our situated conceptions of artefacts *qua* artefacts, subjects *qua* subjects, and bodies *qua* bodies. This course of analysis—discussing A-kinds rather than A-kind terms—has been undertaken previously by Patricia Soley-Beltran (2001) and Irene Rafanell (2003) in dealing with

[47] Despite its manifold problems, the notion of a 'technological paradigm' (Dosi, 1982) might be somewhat useful in describing these models.
[48] This is not to suggest that design and manufacturing are unimportant, simply that they do not unproblematically determine artefact ontologies.
[49] Clearly, referential practice forms a central component of my analysis, and this distinction is somewhat precarious. Nevertheless, the focus of this thesis is the entity, not the term.

comparable questions. I further discuss the relationship between reference, knowledge, and ontologies in Chapter Seven.

Artificial-kinds are ubiquitous, and are a necessary category in the sociology of knowledge. This thesis makes extensive use of the concept to discuss the ontologies of artefacts, subjects, and bodies, and the manners and modalities in which these are rendered intelligible in social life.

3.4 PTSI, Foucault, Butler

This thesis also makes extensive use of Michel Foucault's and Judith Butler's various works in exploring ontologies and intelligibility. Among numerous reasons to do so—most of which I articulate throughout Chapters Four, Five, and Six—is their epistemic concordance with PTSI.

Like the Strong Programme, Foucault's study of classificatory practices (2006 [1966]) and his conceptualization of 'discursive formations' (1972 [1969]) rely on a performative understanding of knowledge and a communitarian epistemology[50]. Moreover, his concern with the relationship between knowledge and social orders (e.g. 1991 [1975] and 1998 [1976]) finds abundant similarities with the Strong Programme. Importantly, his various analyses of knowledge and power (e.g. 1982) contribute invaluably to the Strong Programme's understanding of the 'nature' of power (Barnes, 1988), a topic I discuss in Chapter Seven.

As a Foucauldian theoretician, Butler's epistemic standpoint is closely allied to the Strong Programme insofar as her performative conceptualization of gender demands a communitarian understanding of knowledge (1999 [1990] and 1993)[51]. Her work on citationality (1993) and the iterative constitution of subjectivity (1997) are arguably finitist analyses (see Rafanell, 2003; Soley-Beltran, 2001). Below, I detail her work—first in relation to heteronormativity (1999 [1990]) in Chapter Four and then in relation to subjects and self-knowledge (1997 and 2005) in Chapter Five. Crucially, this thesis makes no use of Butler's psychoanalytic queer theory[52]. Her performative theory of gender stands alone from

[50] For an analysis of Foucault's applicability to science studies, see Kusch, 1991.
[51] For other analyses that employ Butler within a Strong Programme framework, see Soley-Beltran, 2001 and Rafanell, 2003.
[52] For examples of work in psychoanalytic feminism, see Mitchell, 1974 and Irigaray, 1985 [1977].

this other facet of her work, and the latter is ontologically and epistemically incompatible with PTSI[53].

Where relevant, I further discuss the links between Foucault, Butler, and PTSI. Most important here is their epistemic concordance, which enables my use of their scholarship within the framework of the Strong Programme.

3.5 Artefacts, subjects, and bodies

Beginning with Chapter Four and technological artefacts, this thesis interrogates three classes of entities and the processes by which they gain their ontologies in social life. The empirical material I discuss in Chapter Two is rendered through PTSI and employed to resolve important questions in the philosophy and sociology of technology.

I argue that technological artefacts, subjects, and bodies can be analyzed as artificial kinds, ontologically constituted in relation to and interdependently with one another. Technological artefacts are A-kinds *par excellence*. As such, I begin with them.

[53] Its individualistic construction is at odds with the Strong Programme's commitment to communitarian epistemology. I return to this issue in discussing phenomenology in Chapter Six.

Chapter Four: Artefacts

Technological artefacts have been examined from a range of perspectives within science and technology studies. The scholarship on technological artefacts has employed historical (Hughes, 1999), sociological (Latour, 1992), anthropological (Pfaffenberger, 1992), economic (Dosi, 1982), feminist (van Oost, 2003), labour process (Noble, 1999), cultural studies (Miller, 2001), psychological (Turkle, 1982), and philosophical (Feenberg, 2002) approaches in an attempt to understand comprehensively the character of artefacts, as well as their roles within social life. These studies have demonstrated convincingly the complexity and dynamism that characterize technological artefacts.

The present work contributes to this diverse project of enquiry by bringing to bear the theoretical tools introduced in the previous chapter upon technological artefacts, subjects, and bodies as entangled artificial kinds. This research asks the following: in what manner do technological artefacts, subjects, and bodies gain their ontologies, and what modalities do these ontologies take once established? It is my position that these philosophical questions have *sociological* answers, and should be approached accordingly. This chapter demonstrates that there is much to gain from a sociophilosophical enquiry into the character of technological artefacts; similarly, Chapters Five and Six establish the value of such an analysis with regard to subjects and bodies.

The present chapter aims to: establish the locus of objects referred to as technological artefacts; interrogate artefact ontologies using the Performative Theory of Social Institutions; explore the notion of underdetermination as it relates to artefact ontologies; and deploy this sociophilosophical analysis to discuss the issue of heteronormativity in the gendering and sexualization of technological artefacts. In defining technological artefacts, I submit and defend four criteria: materiality, design, functionality, and normativity. The analysis of artefact ontology develops systematically and draws upon empirical material in order to establish the central tenet of this chapter: technological artefacts are artificial kinds. Kusch's concept is at the core of my sociophilosophical approach to the question of artefact ontologies, and it likewise constitutes the foundation of my analysis of subjects and bodies. In my exploration of underdetermination, I further address the social character of ontology by examining artefacts through the Strong Programme's finitism. Finally, I employ these

various arguments by analyzing the heteronormative gendering and sexualization of motorcycles.

Before turning to the question of artefact ontologies, it is necessary to delimitate the possible field of enquiry by clearly defining the locus of objects under scrutiny. I need to define the concept of a technological artefact.

4.1 A definition of technological artefacts[54]

A preliminary step in considering the question of ontologies is establishing the parameters for such an enquiry. Here, this entails the determination of which objects are to be considered technological artefacts—a term used indiscriminately and haphazardly within STS. Without a consistent definition, I believe any consideration of artefact ontologies will be lost within the shuffle of technology studies, an area of scholarship characterized by a motley congregation of disciplinary perspectives. With a common definition of artefacts—one synchronous both with previous and ongoing work in STS *as well as* common-sense notions of technological artefacts—I can bring to bear upon these entities a comprehensive and internally-compatible programme of enquiry drawing from a variety of disciplinary traditions.

Although it may appear self-defeating to define an object *prior to* an examination of its ontology, this methodological move does not represent a curtailment of my concern with ontologies, nor an instantiation of *a priori* determinations[55]. Rather, it represents this work's understanding of the question of ontologies. As determined in Chapter One, ontology here serves not to determine which objects are technologies and which are not, but rather to consider our understanding of any artefact's being—an enquiry into intelligibility and its modalities rather than one aimed at constructing typologies.

The four components of my definition arise from a productive dialogue between the 'Dual Nature Programme' within the philosophy of technology and myself (Kroes & Meijers, 2006; Schyfter, 2009). The definition established a compatible arena for discussing fundamental topics in the philosophy of technology—including ontology, functions, and

[54] I employ the terms 'technological artefact' and 'artefact' interchangeably for textual simplicity. If I refer to another kind of artefact, I make it clear that I am not discussing *technological* artefacts.
[55] Actor-Network Theory in particular argues against *a priori* determinations. However, I believe that certain postulates and premises are necessary in social enquiry, and this thesis is constructed accordingly.

normativity—and now has evolved into a useful framework for delimiting objects of enquiry and establishing common grounds for trans-disciplinary dialogue.

Technological artefacts posses four characteristics: they have obdurate materialities; they are designed; they have functions; and they are susceptible to various forms of normativity. Below, I justify each of these definitional choices. I then demonstrate that all objects meeting these four criteria are artificial kinds.

4.1.1 Artefacts have a spatio-temporal materiality

All technological artefacts exist in space and time; they are physical entities. Unlike 'technological artefacts', the term 'technologies' refers to a much broader class of social phenomena including knowledge, processes, techniques, and practices. These are unquestionably important foci of study in their own right, and are inextricably involved in the development, design, manufacturing, dissemination, and usage of technological artefacts. However, artefacts are fundamentally distinct in that they are material objects; as such, they present unique sociological considerations not immanent in other technologies[56].

Discriminating between material and non-material technologies isolates technological artefacts and enables a systematic study of the relationships between different technologies. Concurrently, this first criterion also poses a notable problem to address. In drawing such strict attention to material objects, researchers are forced to distinguish between technological artefacts and natural, as well as non-technological human-made, physical entities. Thus, this first element of my definition provides the necessary impetus to proceed unto the second criterion.

4.1.2 Artefacts are designed

All technological artefacts are purposefully brought into existence; they are designed both in terms of their physical constitution as well as their operational guidelines (Kroes & Meijers, 2006; Vermaas, 2006). Much of the literature within STS has taken as its focus this process of design, innovation, development, and construction (e.g. Law & Callon, 1992); moreover, sociological and anthropological studies of engineering and engineers have contributed

[56] Consider the following: a computer is a technological artefact. Software is technology, but not an artefact. Despite their mutual reliance, software cannot properly be considered an artefact, and should not be studied as such.

greatly to the field's understanding of design and technological artefacts (e.g. Faulkner, 2007; Law, 1987).

Natural physical entities are not purposefully brought into existence, thus excluding those objects from my definition. This second criterion, however, does not establish fully the boundaries within which the objects of this study reside. Purposefully-constructed material objects—human-made artefacts—are not necessarily technological artefacts[57]. In order to focus this enquiry properly, two additional criteria are required.

4.1.3 Artefacts have functions

Technological artefacts have functions in the sense that humans mobilize them in order to carry out particular tasks (Kroes & Meijers 2006; Varmass & Houkes, 2006; Hansson, 2006; Houkes, 2006). They are purposefully-constructed in order to be employed in the acquisition of an objective. Without a sense of 'for-ness', physical entities cannot be said to have functionality; without function, human-made objects are not technological artefacts.

The precise character of functions is a contested issue (Preston, 2006; Scheele, 2006; Searle, 1996 [1995]), particularly in relation to their origin. In earlier work with the philosophy of technology, I argue that a sociological conceptualization of technological functions contributes a cogent and robust theorization of this phenomenon (see Schyfter, 2009). Regardless of the precise origin of these, no technological artefact is devoid of a task-oriented function[58].

4.1.4 Artefacts have normativity

Technological artefacts may be characterized as possessing a normative component in two senses. First, we routinely speak of agents using an artefact 'correctly' or 'incorrectly'; moreover, specific tokens of an artefact type can be categorized as 'good' or 'bad' (Dancy, 2006; Franssen, 2006). Both of these omnipresent judgements indicate the fundamentally normative quality underlying our interaction with technological artefacts.

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[57] Consider art.

[58] My understanding of function is fundamentally linked to what Schutz refers to as 'in-order-to' motives (1972 [1932]). Schutz himself briefly addresses the topic: "A tool is a thing-in-order-to; it serves a purpose, and for the sake of this purpose it was produced." (ibid: 201)

Normativity is central to the Strong Programme, and my work engages with the topic of technological normativity extensively. We judge a particular usage of a technology as 'correct' or 'incorrect' in the same manner that we judge particular technological artefacts as 'good' or 'bad': through conventional and collective parameters for social practice[59].

Acknowledging the ingrained character of normativity in relation to technological artefacts distinguishes between objects used to accomplish functions—say, a rock used *like* a hammer—and artefacts—the hammer itself (see Franssen, 2006). Moreover, this final definitional component proves a necessary element in my study of technological artefacts.

4.2 Artefacts are A-kinds

Technological artefacts are artificial kinds. While necessarily possessive of an obdurate materiality, technological artefacts *as technological artefacts* are ontologically constituted within social practice. As I state in Chapter One, the property of being-an-artefact is a social institution. This claim is of paramount importance, and its ramifications are manifold. This section systematically argues for this tenet: that artefacts *qua* artefacts exist by virtue of and are intelligible only within social interaction. While its implications are varied, the single most substantial contribution of the artificial kinds model is demonstrating that physical entities cannot in and of themselves be said to possess any form of technological ontology.

Recall that artificial kinds display alter-referentiality in the form of obdurate materiality and self-referentiality in relation to their ontological status. While A-kinds exist in space and time, their ontologies are products of social practice, and take the form of a social-kind status—a social institution. As such, they are: conventional, self-referential, performative, collectively-constituted, and normative.

The argument below proceeds accordingly. Using empirical data and systematic argumentation, I demonstrate that artefact ontologies display the five characteristics of a social institution. Having proven these points, I address the question of artificial kinds.

[59] A more complete argument on normativity and artefacts can be found in Schyfter, 2009.

4.2.1 Conventionality

Artefact ontology, as a social-kind status produced and sustained by collectives of agents, reflects the many variables that characterize the communities responsible for its existence. The phenomenon is conventional, and two facets of the empirical data clearly illustrate communal divergences in ontological modalities. First, the interview participants report the difference between the motorcycling community—taken as a homogeneous entity—and the rest of the Costa Rican populace in contesting the association between motorcycles and danger. While the artefact tends to be understood as a dangerous machine by those who do not ride, my interview participants vehemently argued that the machine is in actuality no more dangerous—and can be considered less risky—than a car. This ontological contest reflects broad conventions and communities. In contrast, the issue of speed and riding—linked to the conventional *usage* of the technological artefact—is significantly more diverse within the motorcycling community. Different groups—while displaying a great deal of internal homogeneity—diverge with regard to the characterization of their motorcycles in relation to speed. These differences in usage illustrate the varied ontologies of motorcycles existent across the span of motorcycling groups.

The concept of danger is a core component of the motorcycle's ontology, and its disparity between drivers and non-drivers demonstrates the conventional character of artefact ontologies. Perceptions of danger appeared consistently during the interviews—most noticeably as a topic of chagrin. The participants almost always discussed danger as a *perceived* property of motorcycles, and not an actual characteristic; motorcycles, most of my participants were quick to point out, are no more dangerous than cars. The general populace, however, tends to portray them as intrinsically dangerous:

> "Other people, the stereotype is, 'that's dangerous, you are very crazy, you're going to kill yourself.' And, and the majority of people will tell you the same stupid thing… People tend to think that the bike is the most dangerous thing. And in a certain way it is dangerous, but more people die in cars than on bikes." (CR-14, male, BMW GS Adventure 1200)[60]

The non-driver understanding of motorcycles—the conventional ontology of motorcycles for non-drivers—is counterpoised against the ostensibly danger-neutral ontology of

[60] My standard practice for attributing quotations is as follows: (Interview code, sex, motorcycle(s) driven)

automobiles. Among non-drivers, cars are predominantly understood as artefacts of transportation, while motorcycles are artefacts of risk and danger:

> "Nobody criticizes when someone dies in a car. They say, '*hijole*, he killed himself.' But if they see a guy who fell off a bike, they say, 'son of a bitch, for riding a bike,' right? It's a stereotype. In reality there is a very, very set idea that motorcycling is synonymous with death, right?" (CR-20, male, BMW GS Adventure 1200)

Against this majority conceptualization of motorcycles stands the ontology constituted within the motorcycling community writ large. Unlike non-drivers, those who participate within motorcycling groups have a substantially different understanding of motorcycles. Rather than refer to these machines as dangerous, drivers discuss them as comparable to cars in the degree of risk inherent to the object itself. Motorcyclists constitute these artefacts in a manner distinct from that of non-drivers:

> "… people say that motorcycling is dangerous, and this and that. When you drive a bike and go everywhere with it then you feel like, like a confidence that you can do it. I mean, you're not with that fear and anxiousness and all that." (CR-12, female, BMW C 1200)

> "The bike is not the danger… the majority of the, of the accidents and all that are provoked more than anything by car drivers against bikes than bikers by themselves." (CR-34, male, KTM Adventure 990)

These two quotations illustrate the conventional distinctions between driver and non-driver artefact ontologies; they also point to the importance placed upon physical practice. Argues one driver: "… there is no safe or dangerous. It depends on how you drive." (CR-13, male, BMW GS 1150) The conventional character of artefact ontologies is a product of not only reference—here examined through the notion of danger—but also physical practice. Many conventional distinctions between motorcycle ontologies are functions of usage. The manner in which a particular group rides translates into a particular constitution of the artefacts' ontologies. Of notice here is the conventional practice of speed.

There exist significant differences in the speeds at which different groups tend to ride. Within motorcycling communities, speed is a consensual phenomenon. Because many Costa Rican groups are organized by machine type, and because groups ride in fairly close formation, average speed is extremely homogenous during trips. Speed as practice is conventional, and has considerable influence on the constitution of artefact ontologies. Two riders who drive cruiser-style motorcycles state:

> "… although we have machines that are up to 2,000 cubic centimetres one of the, the, the philosophy is enjoy the ride, enjoy the trip. So we don't go at high speeds." (CR-21, male, Harley-Davidson Sportster 883)

> "… we go at a speed here on the highway we go at a maximum speed of 80 k.p.h., we almost never race because at the end of the day we went out to take a trip…" (CR-26, male, Honda Shadow 500)

These riders articulate similar worldviews regarding speed. Within their groups—Steel Angels and Coyotes, respectively—speed is secondary to the ride itself, and the motorcyclists tend to drive at relatively low speeds, with an average ceiling of 80 k.p.h[61]. The artefact is understood as a vehicle for enjoying the trip in a manner independent from speed. Contrary to this convention, a member of Tico Superbikes—the largest sportsbike group in Costa Rica—states:

> "… I love going on my bike and having a colleague pass me on one wheel on the track, right? At 150 [k.p.h.], wuuuuuuh, right? Or going with everyone at 200 [k.p.h.] and above until *La Liga*[62], right?" (CR-31, male, Kawasaki Ninja ZX69 636)

The conventional speed within this group is approximately twice that of the clubs discussed above, and the practice of riding at very high speeds is centrally involved in every trip taken by the members of Tico Superbikes. The other members I interviewed from the group similarly reported that their enjoyment of riding is directly linked with high-speed travel, and displayed the same passion as CR-31 above. Here, the ontology of the machine is characterized by the practice of high speed. The artefacts are understood by the members of Tico Superbikes as objects of velocity; this artefact ontology is a function of racing on the track and the highway.

The different manners in which drivers and non-drivers refer to motorcycles as dangerous or safety-neutral artefacts illustrate conventional differences in referential practice. The differences in the practice of speed evidence the conventionality of usage and its influence upon the ontological constitution of the artefact.

Artefact ontology is *conventional*.

[61] Generally, the speed limit on Costa Rican highways is 80 k.p.h. Driving at or faster than 120 k.ph. is considered reckless driving.
[62] A football stadium, here employed as a landmark for gauging distance travelled.

4.2.2 Self-referentiality

As with all bootstrapped phenomena, artefact ontology is self-referential. Although motorcycles exist with obdurate materiality, their existence *as motorcycles* is a product of social practice; without a community of agents to refer to and use particular objects *as technological artefacts*, these entities are no more endowed with a technological ontology than are rocks, trees, or cats. The fundamental problem of determining what constitutes a motorcycle—or any category of technological artefacts—demonstrates the self-referentiality of artefact ontology. Here, I draw upon the contested character of scooters as 'proper' motorcycles in asserting this argument. Moreover, I consider the unique case of Harley-Davidson to further argue that artefact ontology is perceived, discussed, and mobilized as a form of essential quality derived from sources other than the physical object itself. In doing so, I establish the self-referential character of technological artefacts' ontologies.

A fundamental and necessary element in the ontology of all kinds that possess an alter-referential component—that is, natural and artificial kinds—is a mechanism by which individuals determine the extent and boundaries of the class of objects. Classificatory schemata are required for agents to identify entities as belonging to particular groups of objects. These models and paradigms are social institutions, and as such are self-referential:

> It is easy to see why models and paradigms are a self-referential component: nothing is a model for anything in and of itself; a model or paradigm is what is collectively taken to be a model or paradigm. (Kusch, 1997: 17)

Technological artefacts abound with classificatory schemata. At the most basic level, models are required for classification to occur: consensus must exist regarding what objects are taken as valid tokens of an artefact kind, and what properties constitute the model for this class of objects. Moreover, a range of functional schemata are associated with any artefact. For the present argument, I discuss the former variation, as it underlies the self-referential character of artefact ontologies.

As I discuss in more detail below—when considering underdetermination—the material variation within the broad class of objects referred to as 'motorcycles' is considerable. The physical variation within more specific categories—for instance, choppers, cruisers, sportsbikes, enduro bikes—is less pronounced but nevertheless similarly extensive. What the motorcycle community tends to consider a motorcycle is an accurate proxy for the

classificatory schema underlying the referential practice responsible for this artefact's ontology. The classification of scooters is a revelatory case with regard to this problem. Scooters can be tentatively defined as two-wheeled motor vehicles that display particular characteristics in contrast with the majority of two-wheeled motor vehicles, such as a step-through frame, comparatively small wheels, an engine located under and behind the driver, automatic transmission, no pedals, and a motor with relatively low displacement. The question of import here concerns the inclusion of scooters within the broader category of motorcycles. Oftentimes, scooters are excluded due to social causes—not physical ones—deeply embedded in the classificatory model. As such, the ontology of an artefact as a motorcycle is dependent upon communal models and consequently is self-referential.

While some particularly enthusiastic members of the motorcycle community consider the class of motorcycles to include "[e]verything that has two wheels," (CR-13, male, BMW GS 1150), this sentiment of inclusiveness is not a prevalent characteristic of those I interviewed. Rivalries between styles of motorcycles are frequent, as are rivalries between brands within the same style—say, between Harley-Davidson and all Japanese cruisers. The argument over what comprises a 'real' motorcycle achieves its apex when considering the question of scooters, which are often refused membership within the 'broad church' of motorcycles:

> "… I've met people, I mean the mechanic, or people who go to the shop when I'm there, let's say, it's as if scooters are… not a respected method of transportation, right?" (CR-04, female, Honda Rebel 250)

This participant was expressing her perception—as a former rider of scooters—that the artefacts are often relegated to a different class of machinery. Other participants discussed similar experiences of disapproval or so-called 'elitism' within the motorcycle community by drivers of larger machines:

> "Today I was at the gas station, for example, waiting to fill the bike with some gas and there was a [guy] with a huge BMW behind me and he was like, looking this, this thing… He was looking me over, as if saying, 'ugh, how awful, I won't get involved with that.'" (CR-32, female, unspecified scooter)

While drivers almost always talk to one another in such circumstances, here the BMW driver refuses to acknowledge the smaller scooter as a motorcycle at all—a common experience for CR-32 when encountering drivers of larger machines. Scooters were consistently elided in the interviews as anomalous objects not belonging to the motorcycle category. Many of the participants, and certainly all scooter drivers, noted the ubiquitous 'elitism' surrounding this

classification, and traced its foundation to the widespread belief that scooters do not belong amongst motorcycles. This classification rests upon social norms and patterns of valuation[63]; it is a self-referential system. The attribution of a particular artefact ontology rests upon social criteria.

Further proof of the self-referentiality of artefact ontologies can be found in the particular case of Harley-Davidson, and what may be termed the 'Harley lifestyle'[64]. A majority of the interview participants—both those who owned Harley-Davidson motorcycles and those who did not—discussed the Harley-Davidson as "a bike that, that's associated with a lifestyle." (CR-27, male, Harley-Davidson Roadking 1338) Unlike machines produced by other companies, the Harley-Davidson motorcycle is defined by the social aura of the brand:

> "The Harley-Davidson encompasses everything, right? Comfort, quality, umm, what's it called? The *myth* that surrounds Harley-Davidson…" (CR-24, male, Harley-Davidson Sportster 883; my emphasis)

The ontology of Harley-Davidson as a specific category within the broader class of motorcycles is dependent upon a series of practices, symbols, and 'myths' implied by the brand and the community of drivers[65]. The ontology refers only back to itself as a social status, and is characterized sometimes as an essential quality present only to those who possess the machine:

> "They have another saying too, when they are asked, 'what's it like to ride a Harley?' and they answer, which turned into a popular saying of, of Harley drivers, that, 'if I could explain, you wouldn't understand.' You have to have a Harley to, to understand." (CR-13, male, BMW GS 1150)

What a Harley-Davidson is—its ontology—depends on knowing what it is. The understanding of the machine is self-referential.

This sub-section demonstrates that artefact ontology displays self-referentiality by examining two of its forms. First, I delineated the self-referentiality of the schemata employed in the classification of scooters as not-motorcycles, taking care to illustrate the

[63] Of course, governmental designations of motorcycles are often based upon 'purely technical' properties such as displacement. Nevertheless, there exists no such thing as the 'purely technical', and any system of classification—based upon machinery or not—is ultimately always a social phenomenon.
[64] For a report on Harley-Davidson and its corporate image, see Hamner, 2009.
[65] An entire research project might focus on the semiotics of Harley-Davidson (see Barthes, 1972 [1957]).

social origins of these models and paradigms. Second, I discussed the particular case of Harley-Davidson to argue that the ontology of these artefacts refers back upon itself.

Artefact ontology is *self-referential*.

4.2.3 Performativity

Artefact ontology is performative in the sense that social practice brings into existence a state of affairs that previously did not exist (Austin, 1962). In the most elementary sense, the nominative terms used to refer to all technological artefacts are performative. In naming a particular physical entity a 'motorcycle', the agent is endowing that object with a classification, and the aggregated utterances of mutually-susceptible agents constitute and maintain the system of classification (Barnes, 1983). This observation is true of any label or categorization, and accordingly does little to illustrate the manner in which artefact ontology is a performative phenomenon. In this sub-section, I document two related practices—customization and motorcycle collecting—that evidence my claim to performativity. These two practices proffer substantial proof that through both material transformation and usage, artefact ontology is performed.

The practice of motorcycle customization—a ubiquitous activity within motorcycling but particularly associated with cruisers and choppers—presents the first case in the performativity of ontology. Customizing a motorcycle consists primarily of purchasing and installing accessories and add-on parts, and detailing the machine with aesthetic modifications such as paint or chromed components. While some variation of this practice exists within all motorcycle styles, it finds its most exuberant articulation within communities of cruiser or chopper motorcyclists. Drivers of these machines view a newly-purchased motorcycle as a *tabula rasa*; it is incumbent upon the driver to personalize the motorcycle through physical modification and give it its identity:

> "… I bought an Intruder, it was because the bike lets itself be stylized. I bought it let's say stock and, and made it, with respect to my personality." (CR-16, female, Suzuki Intruder 800)

> "One of the characteristics of the Harley-Davidson is that they give you a stock bike and part of the game or part of the passion, right, is to start to buy it chrome pieces, to change the ones that it originally brought and obviously chrome pieces from Harley-Davidson, right? So it becomes like a game, right, to go putting pieces on it

> and pieces and pieces and pieces, to go building your own bike." (CR-27, male, Harley-Davidson Roadking 1338)

> "… it's a way of personalizing the bike, right? That it doesn't stay exactly how you bought it or the same as the ones that are on the street, right?" (CR-19, female, Honda Shadow 600)

Until the owner of the motorcycle has taken to adding the modifications, the machine is lacking completion: it is simply a stock machine. The collective understanding of these motorcycles is subject to the process of customization and personalization carried through by the owner:

> "So you say, 'there goes [CR-13's] bike'. 'Why? If he's going with a closed helmet, with a jacket, all in black, and you can't see his face?' 'Yeah, it's that [CR-13's] bike has the rims a certain way… the mirrors are like this,' and so you can identify the person even by the machine." (CR-13, male, BMW GS 1150)

The machine is a specific machine through customization. That is, the ontology of the artefact is dependent upon the physical alteration of the machine and the subsequent presentation of the completed work to other members of the collective and society at large—a fundamental component of customization is the eventual public display of the machine, and is associated with 'showing off' the quality of the modifications. As such, the practices of physical alteration are embedded within a community of mutually-susceptible drivers, and it is in the *doing* that a motorcycle comes to be complete as a motorcycle. The practices are performative.

The second case that substantiates my claim concerns motorcycle collecting. Although a far more exclusive practice than customizing, a surprising number of participants owned vintage motorcycles for no other reason than to restore and collect them. Oftentimes, the practice extended over a number of years, during which the owner gradually restored the motorcycle from dilapidation. These machines are intended to serve as objects to be restored, cared for, and admired; they are not intended for use. All of the participants who engaged in this practice owned another motorcycle for riding. When discussing their vintage motorcycles, they clearly differentiated between the artefact as an aesthetic object and motorcycles intended for driving:

> "One is a Suzuki GTE 750M, '75, which is a 3-cylinder, 2-stroke, water-cooled motor. It's a brand classic… I have it there well cared for but I don't use it. It's what I humorously, and my friends have a lot of fun with this term, what I call a flower

> pot with wheels because I haven't used it… basically I don't use it because of how classic and important it is…" (CR-33, male, Suzuki GSX FE 1400)
>
> "I have a Norton Commando 1973 model with 750 cubic centimetres, completely restored. It's a bike that I spent a year customizing, making it to my taste. I have that one for collecting, let's say, because it's not for riding in the streets. I have it stored in my house." (CR-24, male, Harley-Davidson Sportster 883)

These two participants made it evident that because their respective vintage motorcycles were not used to drive, they were distinct from their other machines, which did make it onto the streets. In not being used to carry out certain tasks, the vintage motorcycles lost their ontologies as motorcycles and instead gained a status as objects of admiration, as exemplars of design and aesthetics. What this case illustrates, and what my participants reported, is the necessity of practice for an artefact's ontology. In the repeated usage of a motorcycle as a vehicle for transportation, its ontology as a technological artefact is constituted; artefact ontology is brought into existence through social practice.

These two cases demonstrate that artefact ontologies are reliant upon continuous social practices for their existence. Without customization, cruisers and choppers are ontologically liminal; the community requires personalization to grant these motorcycles a full measure of ontology. Similarly, the vintage motorcycles owned by CR-33 and CR-24 are objects for aesthetic appreciation—"flower [pots] with wheels"—because of their separation from the conventional practices of motorcycle driving. In and through social practice, ontology is performed.

Artefact ontology is *performative*.

4.2.4 Collectivity

As a social institution, artefact ontology is a collective accomplishment. This aspect is particularly important when employing the Strong Programme's Performative Theory of Social Institutions, as this school is founded upon a communitarian epistemology. Moreover, the emphasis given to the collective constitution of social institutions proves invaluable in addressing some fundamental questions posed by the sociology of technology. In demonstrating here that artefact ontology is a collectively-constituted phenomenon, I formalize a line of argumentation that precedes this sub-section; collectivity is analytically implied in considering questions of conventionality, self-referentiality, and performativity. Here I further demonstrate the collective character of technological artefacts' ontologies,

with the aim of substantiating the most fundamental aspect of this sociology of technology. I first discuss the importance given to the group by motorcyclists, and the manner in which the collective is inexorably at the core of the artefact's ontology. In doing so, I document the extent to which intersubjectivity and social interaction make the motorcycle intelligible as a gregarious artefact. Second, I consider the case of 'classism' and 'elitism' amongst motorcycling communities. The labelling of certain motorcycles as classist artefacts is a function of their integration within brand-exclusive groups and the practices of these groups' members. These two examples illustrate the manners in which artefact ontology is a collectively-constituted phenomenon.

The majority of my interview participants[66] are members of at least one of the many motorcycling groups active in Costa Rica. Even participants who prefer driving alone oftentimes take longer trips with a group of friends and most[67] at some point have attempted riding with an organized group. The popularity, number, and heterogeneity of motorcycling groups in Costa Rica is a testament to the importance of the collective for motorcycles' ontologies. The largest group of non-affiliated motorcycle drivers consists of courier motorcyclists, whose use of the machine is defined by their profession. However, even courier motorcyclists have regular meeting places around San José, at which they stop to eat, relax, and talk about motorcycles. A smaller, although growing, number of drivers use their motorcycles simply as methods of transportation. Nevertheless, even within this group a large contingent chooses to engage in organized riding on the weekends. My participants repeatedly described collective riding as a fundamental component of the motorcycle:

> "… sitting down with 20 people or similar couples with the same tastes as mine to have breakfast on a Sunday in the morning, on the way to Puntarenas or on the way to Guápiles or on the way to Turrialba, sit down, share, a group of friends, all with, with the same, with the same love for bikes… I couldn't do it with another medium that wasn't the bike." (CR-26, male, Honda Shadow 800)

For CR-26, the motorcycle is unique in its capacity to exist as part of a community. Both members and non-members described the importance of interaction with other motorcyclists. The motorcycle was consistently characterized as an artefact within a broader social practice, as a machine defined by its ability to craft intersubjectivity:

[66] 28 of 36.
[67] 31 of 36.

> "… more than a medium of transportation, it's a medium of integration, it's a medium of sharing…" (CR-21, male, Harley-Davidson Sportster 883)

> "It's a group sport, it's a sport that although it's practiced individually, you, you have it alone, you can have your weekend alone, if you want, it finds identification, it finds sociality." (CR-05, male, BMW RT 1200)

Thus artefact ontology is a product of a collective experience, and it is within collectives that the motorcycle finds its intelligibility as a technological artefact. The ontology of this particular machine is defined by groups of agents engaged in similar practice. The differentiated practices of the various groups—as discussed above regarding speed—further evidence the importance of collectives for artefact ontology.

Further proof of collectivity is found in the case of 'classism'[68] and 'elitism' amongst motorcycle drivers in Costa Rica, and the manner in which particular groups and motorcycles are identified as 'classist'. As they do for automobiles, prices vary greatly for motorcycles; Hondas, Suzukis, or Yamahas may cost $12,500, whereas more expensive brands—such as BMW and Harley-Davidson—may cost upwards of $25,000 and $18,600, respectively[69]. High prices *may* result in particular correlations between economic class and brand, but the association is not guaranteed, and several of my interview participants could be regarded as notable exceptions. Price alone does not determine the 'elitism' of a motorcycle. My research indicates that group affiliation and collective practices are far more influential in the ontological constitution of a motorcycle as a 'classist' machine.

The two clubs most often derided as being 'classist' or 'elitist' are the BMW Motorclub and the Harley Owner's Group (H.O.G.)—the only brand-exclusive groups in Costa Rica. It is by virtue of an agent's participation with these groups, and the perceived norms and mores of the collective, that the driver and the motorcycle are categorized as 'classist'[70]. The BMW Motorclub is often referred to as a grouping of wealthy, 'classist' drivers:

> "There are different social classes in motorcycling. The BMW club is the BMW club." (CR-22, male, Honda Goldwing 1832)

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[68] Recall from sub-section 2.4.3 that class is a participants' schema here. For most of my participants, income level and profession were proxies for economic class, which was not distinguished from class more generally.

[69] These prices reflect a random sampling of motorcycle dealerships in Costa Rica. The prices are in United States Dollars.

[70] Again, categorized by other motorcyclists. See sub-section 2.4.3.

> "To the BMW group they say, those are the sophisticated ones, the ones that don't, the ones that are a bit snotty, if you will, who are a bit, a bit classist because they won't go to just any *pulpería*[71], right, to drink a soda. They go to the Marriot to have breakfast, they don't go to the *pulpería* in Jacó…" (CR-05, male, BMW RT 1200)

These two participants refer to the group as the source of this reputation. It is because the group stops at particular restaurants that it gains a status as an 'elitist' collective. The motorcycle is accordingly given an ontology that reflects this practice. The BMW is not a 'classist' motorcycle because it is a BMW; the BMW is 'classist' when in concert with the activities of the BMW Motorclub. The collective constitutes the machine in a particular fashion; ontology is not an essential property: rather, it is generated by the collective. The Harley Owner's Group endows its artefacts with a comparable ontology:

> "… when you see the Harley club you say, "yeah, the arrogant club," because that's the term, right? The ones with money, right, who like riding on a Harley… so the Harley, it's a very classist bike." (CR-20, male, BMW GS Adventure 1200)

> "[Harley Owner's Group] has its trip every month too, which is more classist…" (CR-21, male, Harley-Davidson Sportster 883)

Once again, these quotations are indicative of the collective constitution of artefact ontology. Due to the patterns of behaviour attributable to H.O.G., the motorcycles within the group gain a particular ontology. Those motorcyclists who drive Harley-Davidson machines with non-exclusive groups are not categorized similarly; the 'classist' ontology is a function of group affiliation and conventional practices.

These two cases evidence my claim that artefact ontology is a collective accomplishment. Motorcycles have an ontology inseparably linked with social interaction and motorcycle collectives; the group, through its collective practices, defines the artefact as a motorcycle. Moreover, the case of class illustrates the manner in which group practices generate a particular ontology for particular artefacts.

Artefact ontology is *collectively-constituted*.

[71] Colloquial term for general store / newsagent.

4.2.5 Normativity

Finally, artefact ontology is a phenomenon responsive to normative judgements and sanctioning practices. In Chapter Three, I discuss the necessity of normativity and sanctioning for the existence and stability of social institutions, as well as their considerable sociological importance. Moreover, normativity is a fundamental property of all technological artefacts. As such, the problem of normativity is at the very core of this research project. Here I first briefly consider the basic formulation of normativity in relation to reference—calling an artefact by its proper name—before discussing the more complex issue of artefact quality—collective determination of whether an artefact is a 'good' exemplar or a 'bad' exemplar of an artefact class. Last, I discuss the relationship between usage and normativity as it informs the question of artefact ontology. This final argument further demonstrates the importance of physical practice in the ontological constitution of technological artefacts, and highlights the normative aspect of use.

Reference to all technological artefacts is normative in the sense that "it is an essential feature of concepts that they can be applied *correctly or incorrectly*" (Kusch, 1999: 255, my emphasis). When an agent refers to a particular object as being a specific technological artefact—say, a sportsbike—his/her reference is correct only insofar as the remaining members of the collective deem it to be so. Referring to a 'cruiser' as a 'sportsbike' would be 'incorrect' due to a collectively-stipulated differentiation between multiple spatio-temporal entities endowed with broadly similar physico-chemical properties and collectively-determined functions. Misapplication of the label is met with collective sanctioning (Kusch, 1999). As I argue in Chapter Three, without this form of normativity, concept application would be impossible. However, although this is a necessary component of the normative facet of artefact ontology, it is only a minor element.

Reference to the quality of technological artefacts is associated more substantially with the ontological constitution of artefacts. As Franssen (2006) and Dancy (2006) note, a salient quality of technological artefacts is their susceptibility to normative judgements of performance. We constantly evaluate technological artefacts in normative terms. Collectively-constituted determinations regarding the quality of a particular motorcycle—whether the machine is 'good' or 'bad'—provide ample evidence that an artefact's ontology is susceptible to normativity. Importantly, all normative evaluations rely upon collectives; as such, this facet of artefact ontology is inseparable from collectivity and conventionality.

Sociologically, demonstrating the prevalence and pervasiveness of normativity in the ontological constitution of artefacts requires an examination of specific groups. While I identified a myriad of criteria used to normatively evaluate motorcycles—including functionality, brand name, comfort, safety, speed, and power—particular benchmarks were employed by particular collectives. Whereas Harley-Davidson motorcyclists—and the Harley Owner's Group accordingly—tended to value brand name recognition, looks, and noise, those driving BMW motorcycles were prone to value technological sophistication and stylistic modernity.

Within the BMW Motorclub, a 'good' motorcycle is defined in a very specific manner; those who ride BMW motorcycles value sophistication above all else. This particular normative stipulation is manifest in several modes. In its broadest sense, 'sophistication' refers to style, to taste, and to the general modernity of the machines:

> "So you start looking for something more *sophisticated*. Your tastes become more, you could say, they get better. So you start looking for the European taste. So that's where the BMWs appear, which are very silent, very conservative, very high-tech bikes…" (CR-05, male, BMW RT 1200; my emphasis)

> "… the BMW style, which is the bike, I think it's the strongest bike that exists, with the best design, the best engineering, *it's not a scandalous bike*…" (CR-17, male, BMW GS 1200; my emphasis)

The ontology of the artefacts as sophisticated, tasteful, and 'European'[72] machines is necessarily a function of the collective superordination of particular characteristics. Loud, garish machines—generally cruisers and choppers—are held to be lesser motorcycles for their lack of tact and style. Moreover, 'sophistication' also refers to technological refinement:

> "Let's start first with the degree of *sophistication*, of the, what's it called, the engine. Everything that has to do with, what I mentioned, about power, torque, *sophistication*…" (CR-01, male, BMW GS 1200; my emphasis)

> "It's a quality motorcycle with impressive technological advancements with respect to the rest of the motorcycles on the market, right?" (CR-09, male, BMW GS Adventure 1200)

[72] Here 'European' refers to more than simply the geographic location of BMW. In Costa Rica, the term 'European' encompasses many notions of Continental sophistication.

> "That's very very important, good technology. The BMW has very modern technology, and very safe technology for motorcycles." (CR-12, female, BMW C 1200)

Members of the BMW Motorclub—unlike owners of cruisers—consistently identified technological sophistication as a core component of their machine's ontology as well as a fundamental property of 'good' motorcycles. Conversely, motorcyclists who owned cruisers would rarely—if ever—mention technology; instead, they emphasized looks and tradition. Collectives determine their own normative standards for motorcycles, and these are fundamental components of the artefact's ontology.

The second sense in which artefact ontology is normative relates to usage. Recall that function is a fundamental component of all technological artefacts; a sense of 'for-ness' is necessary for any object to be considered a technological artefact. As such, what-a-thing-is-for is a crucial element in the ontological constitution of artefacts. My argument regarding the normative character of artefact ontology would be incomplete without exploring the ramifications of usage in relation to an artefact's ontology. My participants engaged with the issue of normativity in response to my questioning them on what 'makes a good motorcycle'. Often, they discussed normativity as following from a consideration of the practices associated with a particular motorcycle:

> "A good bike depends on what you want to use it for. What is a good bike for different purposes? A good bike for Costa Rica, for trips, is like the one I have, a GS. If you wanted to go here on the highways, if you find any, well then you have a sportsbike, right? If you wanted to go on the mountain, you'd have an enduro for the mountain… So it depends a lot on the category in which you want to use them." (CR-03, male, BMW GS 1200)

Normative evaluations of any particular motorcycle cannot be dissociated from the context within which the artefact is being used and the practices it is being employed to achieve. Thus a particular artefact's ontology as a 'sportsbike' is normative in the sense that this specific ontology is defined partly by a series of practices that can be performed 'correctly' or 'incorrectly' and which inform a collective's understanding of that motorcycle. A sportsbike is a 'good' motorcycle insofar as it is *not* being employed to ride on off-road trails; an enduro off-road motorcycle is a 'good' motorcycle when it is *not* being used to drive very long distances at high speed. The practices expected of and accomplished with particular artefacts shape the ontology of the artefact. Importantly, this observation does not

indicate that function determines ontology or normativity; rather, it points to the social bases for all three of these phenomena.

Artefact ontology is normative in a variety of manners. First, there is the fundamental normativity of referential practice. Second, the collective establishment of normative standards directly inform the group's constitution of an artefact's ontology. The BMW Motorclub understands a BMW motorcycle as a 'good' machine because it superordinates sophistication—a quality it understands as being part and parcel of those motorcycles' ontologies. Third, there exists the influence of usage upon an artefact's ontology, and the manner in which physical practice operates in the normative evaluation of a particular artefact. What an artefact is—its ontology—is susceptible to judgements of quality—normativity—based upon the practices associated with the artefact and which the driver carries out—usage.

Artefact ontology is *normative*.

4.2.6 Technological artefacts are A-kinds

I have demonstrated analytically and empirically that artefact ontology displays five characteristics: it is conventional, self-referential, performative, collectively-constituted, and normative. Artefact ontology is a social institution. Having established that technological artefacts' ontologies are social institutions—social-kind statuses—I can now prove my earlier claim that all technological artefacts are artificial kinds.

Technological artefacts possess an obdurate materiality independent of referential practice—artefacts have an alter-referential component. My definition of technological artefacts above establishes this as its first postulate, in an attempt to differentiate technological artefacts from other technologies, such as technological knowledge and practice. Additionally, the spatio-temporal existence of technological artefacts is (analytically) self-evident, and reflects 'everyday' experiences with the obdurate materiality of these objects. It would be preposterous to speak of riding, tuning, touching, painting, damaging, or fixing a motorcycle otherwise, not to mention speaking of feeling its vibrations, hearing its engine, or gripping its handlebars[73]. Moreover, recall from Chapter One that this underlying materiality is granted, as my thesis is not an ontic study of artefacts.

[73] These are topics discussed at length in Chapter Six.

A second argument in favour of an artefact's materiality derives from the nature of artefact ontology as a social-kind status. Argues Kusch:

> Social statuses and functions are imposed upon something or other, and ultimately this something or other must be identifiable on the basis of its spatio-temporal features… Social statuses are 'imposed' upon spatio-temporal entities; if we were unable to identify the latter then we would be incapable of identifying the former. (Kusch, 1999: 266)

In the case of artefact ontology, the spatio-temporal entity consists of the 'raw' materiality of the technological artefact. The metal, plastic, leather, and other materials that comprise the physical structure of a motorcycle are the physical material upon which a social status is imposed. Without this social status—artefact ontology—the material remains simply material.

The intelligibility of the motorcycle *as a motorcycle* arises not from its physical properties or some form of essential quality, but rather from the collective practices that constitute its ontology. The artefact is not to be found in its structure. This in no way elides or delegitimizes the physical constitution of technological artefacts. This must be unequivocally clear: materiality is crucially important. Its role as the material basis upon which social practices make artefacts intelligible is crucial, but is also necessarily limited. This is not to subscribe to a form of technological idealism, only to note the point that outside societies and collective practices, technological artefacts have no basis upon which to claim their ontology *as artefacts*. This topic is further explored in section 4.3.

I have demonstrated a series of points. Firstly, artefact ontology is a social-kind status. Secondly, all technological artefacts possess a physical materiality. Thirdly, physical materiality is not a sufficient condition for any entity's ontology as a technological artefact. Lastly, all social-kind statuses are imposed upon physical entities. As such, I can now state that technological artefacts, while existent with an obdurate materiality, have an ontology that is fundamentally self-referential.

Technological artefacts are *artificial kinds*.

4.3 Underdetermination

As artificial kinds, technological artefacts are products of social practice. A fundamental—and here crucial—repercussion of this analytic formulation is *underdetermination*. Although not a concept regularly applied within technology studies[74], underdetermination is a necessary and pivotal component of my sociophilosophical approach to artefacts, subjects, and bodies. Moreover, it is a key element of the Performative Theory of Social Institutions, within which it takes the form of Wittgenstein's meaning finitism.

Underdetermination is often encapsulated by the work of Willard van Orman Quine[75] (Ariew, 1984; Quine, 1953 and 1979). Within Quine's argument, all natural science is underdetermined in the sense that scientific practitioners may produce multiple, separate and irreducible frameworks of explanation despite equivalent empirical data; that is, empirical equivalency may lead to theoretical multiplicity. Empirical observation does not in and of itself lead to scientific theory, and empirical equivalence need not equate with theoretical identity because natural science is "under-determined not just by past observation but by all observable events." (Quine, 1979: 313) This claim has had appreciable influence within science studies, and despite its absence as an explicit theoretical tool within technology studies, a survey of prominent work reveals that underdetermination has significantly influenced this field of study as well.

Here, underdetermination follows from my analysis of technological artefacts as artificial kinds; it is a necessary and exceptionally useful repercussion. The sociophilosophical approach developed in this thesis reveals that *all artefact ontologies are underdetermined by materiality*. This section addresses the manner in which I conceptualize this important observation. First, I briefly explore the relationship between Quine's underdetermination and the Strong Programme's finitism, drawn from Wittgenstein's work on meaning. Second, I discuss the relationship between artefact ontology and underdetermination, while at the same time making links between this argument and the central tenets of the Strong Programme's finitism. Last, I recapitulate the role underdetermination plays in my sociophilosophical analysis of technological artefacts, and discuss its importance for empirical case studies.

[74] A notable exception here is Pinch & Bijker, 1984.

[75] The underdetermination tenet is often labelled the 'Duhem-Quine Thesis', despite a range of arguments that convincingly distinguish Duhem's notions of separability and falsifiability (Ariew, 1984; Duhem, 1954) and Quine's reformulation of Duhem's work on underdetermination (Ariew 1984; Quine, 1953 and 1979). To avoid this philosophical quagmire, I only draw upon Quine's work here.

4.3.1 Quine and Wittgenstein: Underdetermination and finitism

Within science studies, underdetermination has played a significant role in framing the pervasive problem of observation and theory-building. In both historical and sociological studies of science and scientific knowledge, this philosophical tenet has aided researchers probing the practices, institutions, rhetoric, and instruments of science. The argument is in use as early as Kuhn's work on the history of scientific developments and the interplay between scientific investigation, discovery, and theoretical paradigms (1996 [1962]). More recently, Quine's thesis has been re-imagined as a tool within the sociology of science and scientific knowledge, particularly in studies of controversy and knowledge contestation[76].

Underdetermination is a central component of the Strong Programme's Performative Theory of Social Institutions. Rather than make use of Quine, however, the Strong Programme employs Wittgenstein's notion of meaning finitism with similar results (Bloor, 1997b and Chapter Three in this volume). When formulated within a sociological framework, the Quinean and Wittgensteinian constructions of underdetermination are resonant and complementary. Quine's articulation of underdetermination addresses the discontinuity between empirical equivalency and theoretical multiplicity (Quine, 1979); that is, it concerns the relationship between equivalencies and multiplicities. Wittgenstein's notion of meaning finitism focuses rather on the nature of language and meaning, arguing that "we create meaning as we move from case to case" (Bloor, 1997b: 19). That is, collectively-constituted meanings are underdetermined by both empirical evidence and previous usage. Fundamentally, the parallels between Quine and Wittgenstein concern this equation between equivalency and multiplicity: given equivalent and finite data, how do we proceed to a particular theory/concept? What factors influence our choice of any given theory/concept over another? Within the Strong Programme, these are fundamental questions, addressed sociologically.

Following finitism, no concept is entirely determined by either empirical data or previous usage. As such, finitism is congruent with the underdetermination thesis, in that it asserts, "the area of reality being inspected under-determines what the scientists say or think about it" and as such, "an analysis of their knowledge must further assume the role of organising

[76] There is not sufficient space here to exhaustively document the uses to which underdetermination has been put within science studies. Consult Pinch, 1985 and Shapin & Schaffer, 1989 [1985] for two studies—sociological and historical respectively—that reflect Quine's argument.

principles and orientations… [such as] tradition, authority, shared models and paradigms, and styles, as well as the scientist's interests or purposes." (Bloor, 1996: 841)

As with Quine's underdetermination, the Strong Programme's finitism attempts to account for the progression from empirical equivalency to meaning. Following the example of concept application, Bloor argues:

> Each and every instance of concept application takes place under the impact of local contingencies… [such as] traditions, precedents, authorities, goals and interests. The fit of our concept to reality is, therefore, not just a matter for reality; it is always a matter (collectively) for the concept user as well. (Bloor, 1996: 853)

Sociological considerations become fundamentally involved in the process between worldly reality and knowledge claim and between physical equivalency and meaning multiplicity. Similar questions and congruent solutions exist for technological artefacts. All technological artefacts are underdetermined by their materiality; physical equivalency underdetermines ontological multiplicity.

4.3.2 Ontology and finitism: Some consequences for technology studies

The study of technology—philosophical, sociological, historical, and so forth as above—is replete with empirical studies of underdetermination by another name. Technological artefacts display underdetermination in myriad ways, including material (Houkes & Meijers, 2006; Pinch & Bijker, 1984), meaning (Pinch & Bijker, 1984), usage (Houkes & Meijers, 2006; Kline & Pinch, 1996), normative (Akrich, 1992), political (Noble, 1999; Schwartz Cowan, 1976), and systemic (Hughes, 1998). Here, I focus upon the problem of ontology[77].

As I suggest above, the physical materiality of an artefact is not a determinant of its ontology; materiality *underdetermines* artefact ontology. Other factors are necessarily involved in the constitution of artefact ontology. It is the position of this thesis that these other factors are *sociological*. Collective practice is responsible for the existence of all social institutions, and the character of these institutions reflects those practices. This relates to technological artefacts inasmuch as local contingencies determine the character of any artefact's ontology. Material equivalency underdetermines ontological multiplicity. This

[77] Consult Appedix E for more on underdetermination and technology studies.

claim carries with it a series of consequences linked with the fundamental tenets of finitism as summarized in Chapter Three.

First, process matters. Recall that *all future instances of concept application are open-ended*. There exists no determinate relationship between previous instances of meaning usage and future instances. A similar consideration of technological artefacts indicates that ontology is a continuous social process, susceptible to changes in social life. An artefact's ontology is not immutable; rather, it is a matter dependent upon the dynamics of collective social practices—such as social orders.

Second, context matters. Above I establish that artefact ontology is both conventional and collectively-constituted. Finitism argues that *no instance of concept application is indefeasibly correct*; consensus and negotiation are fundamental practices necessarily involved in the constitution, use, and maintenance of all social institutions. Different collectives may attribute different and possibly irreconcilable artefact ontologies to the same physical entity.

Third, "traditions, precedents, authorities, goals and interests" (Bloor, 1996: 853) matter. *All acts of concept application are revisable* and *successive acts are not independent*. There is the constant possibility of correction by agents with greater authority, and traditions, paradigms, and interests inform these corrections. Additionally, precedents—in the form of previous acts of concept application—influence each act of classification. These related points contribute various observations to my finitist understanding of technological artefacts. In the constitution of artefact ontologies—as in the constitution of all social institutions—the collective of agents is not 'flat': power differential exist and authority relations are sociologically important. Moreover, history plays a central role in the construction of artefact ontologies through tradition and precedent. Finally, social interests are entrenched phenomena in this process, as I demonstrate below.

Fourth, other ontologies matter. Recall that *applications of different terms are not independent from each other*. In order to understand and classify an entity, certain knowledge of other entities is required. Technological artefacts, as ubiquitous components of social life, are intelligible by virtue of their integrated and situated existence in society. A motorcycle is intelligible in its most basic manner in relation to roads, petrol, and other forms of motorized travel. More specifically, a sportsbike is intelligible by virtue of its

existence among a constellation of other types of motorcycles, such as cruisers and enduro motorcycles. Moreover, other non-technological ontologies are necessarily involved in the constitution of artefact ontologies. As I demonstrate in Chapter Seven, the entanglement of various ontologies—here specifically of artefacts, subjects, and bodies—is a fundamental facet of social life.

4.3.3 Taking stock

This section summarized the concept of underdetermination and noted its relevance to the question of artefact ontology through the Strong Programme's finitism. Recall my earlier discussion of finitism in Chapter Three. I established the priority of use. Meaning follows usage; meaning does not determine usage. A similar conclusion can be drawn regarding the question of artefact ontology. *Artefact ontology follows social practice; ontology does not determine practice*.

This claim—along with the arguments that precede it—is of invaluable use in the sociology of technology. In recognizing the contingent character of artefact ontology, it becomes possible to document and explicate the relationship between dominant social orders—for instance gender and sexuality—and the modalities of artefact ontologies. By exploring heteronormativity in Latin America, I demonstrate both that artefact ontology is a social institution, underdetermined by materiality, and that gender and sexuality play decisive roles in the constitution of this ontology.

4.4 The heteronormative artefact

This section explores the relationships present between gender, sexuality, and technological artefacts in Costa Rica. The case material documents the manners in which motorcyclists understand and use their technological artefacts in a heteronormative fashion. That is, technological artefacts and their users reflect the prominent social valuation of heterosexuality and the concurrent marginalization and subordination of homosexuality—two processes fundamentally implicated in the social order of gender, as I argue below. This section substantiates one claim: *technological artefacts are gendered and sexualized in heteronormative patterns*. This section also serves to evidence a number of claims that I discuss above.

First, by discussing the manner in which technological artefacts are gendered and sexualized, I present further empirical evidence that artefact ontology is a social institution. This argument, which I extensively detail above, underlies my sociophilosophical approach to technological artefacts, and proves invaluable in conceptualizing the relationships between gender, sexuality, and artefacts.

Second, I substantiate my discussion of underdetermination. In tracing the social character of artefact ontology, I empirically demonstrate an artefact's ontological reliance upon social practice. This is a particularly useful component of my argument—both for its theoretical and methodological implications.

Before my empirical argument, I summarize some ideas on the relationship between gender and sexuality. Thereafter, I recapitulate previous work on Latin America that directly addresses these questions. Finally, I advance my own empirical argument before returning to a discussion of the results. Throughout this section, I note the fundamental interrelation between gender, sexuality, and artefact ontologies, and seek to demonstrate that heteronormativity is manifested in various modes of user-artefact interaction.

4.4.1 Theorizing heteronormativity

With the advent of queer theory and studies specifically aimed at examining the marginalization of homosexuality, the superordination of heterosexuality became a fundamental concern for gender studies. Gradually, the problem of heteronormativity has come to be understood as inseparable from the problems of gender discrimination. The persistence of a social imperative towards heterosexuality and the continued subordination of femininities are analytically-congruent social phenomena; the marginalization of a particular kind of desire is not dissociable from the marginalization of a particular gender. Thus for gender studies, theoretical and empirical enquiries into the existence and persistence of heteronormativity are important and necessary tools for feminist scholarship and praxis.

Within feminist technology studies, the terrain looks markedly different. The relationship between sexuality and gender—and in particular the social imperative towards heterosexuality—is a topic that has received little discussion and no dedicated empirical work. Only recently have researchers begun to redress this fault. Notably, Catharina Landström's injunction to feminist technology studies (2007) presses for dedicated

engagement with this problem. Landström forcefully argues that feminist technology studies has not only failed to explore empirically the question of heteronormativity, but has also allowed heteronormativity to "[shape] analyses and concepts in empirical investigations." (Landström, 2007: 7) These two critical failures present significant problems for the field. First, by not successfully problematizing gender, many studies have reproduced heteronormative gender dichotomies. Landström claims that studies of women and technology have proceeded from the assumption that all women (and indeed all men) act in accordance with heteronormative genders. This results in an *a priori* rendering of technology as masculine and femininities (and masculinities) as heteronormative[78]. Landström also identifies an analytic contradiction whereby gender is conceived both in terms of an essential property and as a performed quality. The preponderance of studies drawing upon Butler's performative theory of gender (1999 [1990]) is matched by a seeming drive to examine gender as an immutable essence. In concluding, Landström calls for a renewed interest in the mechanisms of gender within feminist technology studies, with particular attention to the heteronormative patterns at work both among researchers and their research subjects.

The primary difficulty in advancing such a program of research is feminist technology studies' traditional reluctance towards studying sexuality as a phenomenon fundamentally inseparable from gender in social life. By introducing theoretical analyses and empirical investigations that illustrate this interdependence and its ramifications, the necessity of a new emphasis on sexuality can be made evident. In writing this case material I hope to begin to remedy some of these clear flaws. Within feminist technology studies, heteronormativity is fundamental but overlooked; mentioned but not operationalized.

As a first step towards an explicit and integrated analysis of gender, sexuality, and technological artefacts, I propose the use of queer theory to frame the empirical investigation and contribute to the theoretical discussion. More than other concepts in queer theory, Butler's *heterosexual matrix* has succeeded in bringing to bear the question of heteronormativity upon gender studies. Introduced as a core component of her performative theory of gender (1988; 1999 [1990]), the heterosexual matrix is a central—and hotly debated—analytic tool within queer theory and gender studies. Butler defines the heterosexual matrix as:

[78] See also Henwood, 1993.

> … a grid of cultural intelligibility through which bodies, genders, and desires are naturalized… [it is] a hegemonic discursive/epistemic model of gender intelligibility that assumes that for bodies to cohere and make sense there must be a stable sex expressed through a stable gender (masculine expresses male, feminine expresses female) that is oppositionally and hierarchically defined through the compulsory practice of heterosexuality. (Butler, 1999 [1990]: 194, note 6)

For Butler, this matrix is responsible for the association between dichotomous gender and dichotomous sexuality, whereby intelligible genders are defined in relation to intelligible (heteronormative) sexuality. Those genders that operate in conjunction with heterosexual desires are socially intelligible, whereas those that are not compatible with idealized and superordinated heterosexuality are categorized as abject[79] desires and genders. Butler's matrix draws from Foucault's work on discursive formations (1972 [1969]) and their role in determining the 'enunciability' of statements and objects of discourse—as I note below. Butler's concept also derives from previous work on the predominance of heterosexuality, and the social imperative towards heterosexual practice.

Butler draws heavily on feminist theorist Monique Wittig's earlier work on the social contract and heterosexuality in developing her conceptualization of a heteronormative epistemic model. Writes Wittig:

> … to live in society is to live in heterosexuality. In fact, in my mind social contract and heterosexuality are two super-imposable notions. (Wittig, 1992: 40)

Wittig conceptualizes heterosexuality as a fundamental component of social intelligibility. All social interaction is based upon a framework that legitimizes heterosexual practice. Its most significant repercussion is upon acts of classification, which Butler directly addresses in her work on gender differences. Wittig argues:

> … we cannot think outside of the mental categories of heterosexuality. Heterosexuality is always already there within all mental categories. It has sneaked into dialectical thought (or thought of differences) as its main category. (Wittig, 1992: 43)

Thus knowledge regarding gender differentiation is fundamentally structured in relation to and irrevocably linked to heterosexuality as the prime determinant of categorization. All acts of gender classification are necessarily heteronormative. Here it is possible to identify significant congruencies between the heterosexual matrix and PTSI—as both fundamentally

[79] For a discussion on the concept of *the abject*, see Costera Meijers & Prins, 1998.

are concerned with classification. Heteronormativity is one of multiple conventions characterizing our classificatory schemata for genders, bodies and desires.

Butler also draws heavily from Foucault's work on discursive formations (1972 [1969]) and classification (2006 [1966]). The heterosexual matrix is a distribution of knowledge, and can be compared to Foucault's notion of a system of formation:

> By system of formation, then, I mean a complex group of relations that function as a rule; it lays down what must be related, in a particular discursive practice, for such and such an enunciation to be made, for such and such a concept to be used, for such and such a strategy to be organized. (Foucault, 1972 [1969]: 74)

The heterosexual matrix establishes the validity of genders, bodies, and desires through a complex group of social relations and practices. It operates as a classificatory rule that assigns intelligibility based upon concordance with a heterosexual ideal. Much as argues PTSI, systems of classification reflect the social order (see Bloor, 1982).

Thus far, I have examined the heterosexual matrix as an epistemic model, a social imperative, and a classificatory rule. Using PTSI, it becomes possible to conceptualize further the heterosexual matrix as a distribution of knowledge produced, maintained, and intelligible only through social interaction—a system of traditions, precedents, and interests that affects all social practice. The heterosexual matrix is fundamentally involved in the process of classification, and is one of a multitude of local contingencies that affect all processes of collective bootstrapping and all individual acts of classification. Heteronormativity is inevitably ubiquitous.

Butler has addressed the manner in which gender identity (1999 [1990]) and sexed bodies (1993) are constituted through the heterosexual matrix. My suggestion is that technological artefacts are rendered in a congruent manner. If artefact ontology is social, then it is susceptible to the same patterns of heteronormativity, as I demonstrate below.

4.4.2 Gender and sexuality in Latin America

All social institutions are localized phenomena. Sociological research aimed at documenting and explicating social institutions—be they artefact ontologies, genders, or sexualities—must focus correspondingly upon local knowledge and practice. The scope and character of the collectives responsible for different institutions varies with respect to the phenomenon in

question; artefact ontologies may be much more localized institutions than genders, for instance. In all cases, however, it is necessary to identify the salient properties of those social institutions under examination as they relate to the communities and areas under study.

This is a study of technological artefacts, subjects, and bodies; it is also a study of motorcycles located in, belonging to, and vis-à-vis Costa Rica. As such, it is incumbent upon me to contextualize adequately my findings within studies of Latin America broadly and Costa Rica particularly. This sub-section attempts to summarize a range of literature on gender and sexuality in Latin America—both empirical work and theoretical analyses—in order to contextualize the concept of heteronormativity. Broadly, the literature on gender and sexuality in/of Latin America documents the following: gender and sexuality are fundamentally interlinked, and cannot be dissociated empirically or analytically; conceptions of both are founded upon the practices of domination and submission; heterosexuality is idealized, and genders find their apexes within this heteronormative ideal; contingencies matter greatly[80].

Here I expand upon each of these topics, drawing from the literature on Latin America to support my claims. Having done so, I return to the issue of heteronormativity and the heterosexual matrix as these relate to Latin America and my interview communities.

First, gender and sexuality are fundamentally interlinked, and cannot be dissociated either empirically or analytically. Studies of gender and sexuality in Latin America demonstrate that in order to understand gender discrimination, a sufficient appreciation of sexuality is required. Hierarchical differentiation between men and women is necessarily related to the marginalized and subordinated position of homosexuality in relation to heterosexuality. Write Chant and Craske:

> On the matter of everyday practices, heterosexuality has long been an ideal in the majority of *mestizo*[81] Latin America. This has predominated in a form based on a strong hierarchical delineation between male and female sexual behaviours. (Chant & Craske, 2003: 140-141, emphasis original)

[80] In reading over literature on Latin American in general, I selected conclusions substantiated by my own empirical study, thus avoiding arguments not relevant to Costa Rica as a specific case nation.
[81] From the Oxford English Dictionary: "n. A person of mixed European (esp. Spanish or Portuguese) and non-European parentage; spec. (originally) a man with a Spanish father and an American Indian mother; (later) a person of mixed American Spanish and American Indian descent." This description characterizes the vast majority of Latin American populations.

The fundamental importance of heterosexuality—and the corresponding depreciation of homosexuality—is related to the social inequity between men and women. Social understandings of masculinities and femininities are dependent upon and productive of social understandings of heterosexuality and homosexuality. In the case of masculinities:

> … being a man depends on being heterosexual, since anything that might be interpreted as homosexual is construed as feminized and passive. (Craske, 2003: 207)

As I note above, the knowledge and practices that form the basis upon which gender is formulated are equally important in the constitution of sexualities. The literature on Latin America further specifies the character of gender and sexuality, as well as their interdependence.

Second, conceptions of gender and sexuality are founded upon the practices of domination and submission, and of activity and passivity. This claim has long existed within broader studies of gender and sexuality, and students of Latin America have focused on these practices in order to document and explicate the relationship between gender and sexuality. In studying Nicaragua—Costa Rica's northern neighbour—Lancaster identifies the various manners in which masculinity and femininity—both as broad social institutions and qualifiers of particular subjectivities[82]—are related to the practices of domination and subordination (1992). That is, gender is a function of practice rather than an immutable property of individuals mapped unproblematically onto sexed bodies. Masculinity and femininity are articulated *in practice*. Researchers have elaborated upon this point by detailing the physical (Chant & Craske, 2003), discursive (Lancaster, 1992), and symbolic (Szasz, 1998) practices that underlie this double dichotomy (masculine:feminine :: active:passive). Chant & Craske write:

> … Lancaster (1992: 242) observes that 'to take by force', 'to seize', to 'grab hold of' ('*coger*', or sometimes '*tomar*') is to be masculine, whereas 'to surrender', 'yield', or 'give up' ('*rendirse*', sometimes '*dar*') is to be feminine. (Chant & Craske, 2003: 143)

Notably, the emphasis upon knowledge and practice significantly de-stabilizes and reconstitutes the relationship between gender and sexuality. That is, men who engage in

[82] This is a linguistic difficulty in employing the terms masculinity and femininity. I use 'masculinity / femininity' to refer to the broad institutions and 'masculine subjectivity / feminine subjectivity' to refer to particular subject positions (see Chapter Five).

homosexual intercourse are not as a result feminized, as might be assumed. The act of domination—in this case, penetration (see Szasz, 1998)—is predominant in the constitution of an agent's sexuality and gender. The active partner retains a masculine gender. Sexuality and gender are not properties inherent in the individual; they are functions of knowledge and practice. Put otherwise, it does not matter *who you are*; it matters *what you do*[83].

Third, the literature on gender and sexuality in Latin America finds that heterosexuality is idealized, and genders find their apexes within a heteronormative ideal. As is recognized by numerous authors (see e.g. Chant, 2004; Melhuus, 1998; Varley & Blasco, 2000), the family as a social unit as well as a cultural ideal serves as one of several bases upon which gender and sexuality are formulated[84]:

> … messages and meanings concerning gender are transmitted inter-generationally through norms and practices of parenting, conjugality, and filial obligation. (Chant & Craske, 2003: 163)

The traditional heterosexual family as a site for the construction of gendered ideals is of fundamental importance to the study of gender and sexuality in Latin America (see e.g. Camacho Granados, 2001). The family represents an important social, cultural, political, religious, and economic entity in Latin America, and the idealized roles of husband/breadwinner and wife/mother underlie articulations of gender. Various researcher identify the importance of motherhood in constitutions of valuated femininities (Craske, 2003; Lancaster, 1994; Melhuus, 1998). Similarly, valuated masculinities are dependent upon the heteronormative ideal of the husband/breadwinner and head of family (Chant, 2004; Melhuus, 1998; Varley & Blasco, 2000)[85]. That is, without an adequate appreciation for the heterosexual idealization of the family, a complete understanding of gender in Latin America is not possible. These studies also evidence the earlier claim regarding the dependence of gender and sexuality upon each other, as well as the marginalization and subordination of homosexuality.

Fourth, localized contingencies matter. Studies of men and masculinities have long regarded complexity and multiplicity as fundamentally important to the study of gender[86], and the lessons learned in this broader research have not escaped studies of gender and sexuality in

[83] See also Foucault, 1998 [1976] and 1990 [1984].
[84] It is, as Foucault would say, a 'surface of emergence' (1972 [1969]).
[85] I return to this topic in section 5.4.
[86] For the most influential argument concerning multiplicity, consult Connell, 1995.

Latin America (see e.g. Gutmann, 1997; Gutmann & Viveros Vigoya, 2005). While I have noted broad and invaluable observations regarding Latin America, gender and sexuality are localized and contingent phenomena, inseparable from other social institutions. Writes Gutmann:

> … we must examine the influence of generational differences and other factors like class, ethnic group, and region, and explore how these impinge on the realities of what it means to be a man… (Gutmann, 1997: 195)

This observation does not denigrate the importance of the earlier empirical claims on gender and sexuality in Latin America. It simply reinforces my argument that social institutions must be empirically explored locally. However, a comprehension of broad social trends, traditions, precedents, and imperatives is necessary and useful.

These four components of research on gender and sexuality in Latin America are of paramount important in this exploration of heteronormativity and technological artefacts. I have identified a series of critical observations that significantly influence my analysis of artefact ontology below. With these observations in mind, I proceed to analyze the manners in which heteronormativity is centrally involved in the constitution of specific ontological modalities.

4.4.3 Motorcycles, gender, and sexuality

The remainder of this chapter addresses the manners in which heteronormativity is involved in the constitution of artefact ontologies. This argument substantiates one primary claim: *technological artefacts are gendered and sexualized in heteronormative patterns*. While the gendering of technological artefacts is by no means a new topic for feminist technology studies (see e.g. Cockburn & Ormrod, 1994; Mellström, 2003; van Oost, 2003), the importance of sexuality in the process as well as its fundamentally heteronormative character have long been overlooked by the discipline (Landström, 2007). Expanding upon this tradition, I demonstrate the prevalence of heteronormativity in the gendering and sexualization of technological artefacts. In doing so, this case material also substantiate three secondary claims.

First, artefacts are made intelligible as gender and sexuality are made intelligible. As I note and reiterate above, all technological artefacts are bootstrapped. Artefact ontology is a

product of social practices. Much as gender and sexuality are functions of shared knowledge and practices, technological artefacts rely upon collectives for their intelligibility. My argument here demonstrates that the patterns of social practice that validate particular genders and sexualities similarly influence artefact ontologies. Technological artefacts are not made intelligible as artefacts in manners and modalities free from dominant notions of gender and sexuality; they are not immune from heteronormativity.

Second, it is possible to conceptualize the influence of heteronormativity by deploying Butler's heterosexual matrix as an analytic tool. The heterosexual matrix functions as a localized distribution of knowledge; it is a system that influences social practices such as classification and is itself constructed and maintained by concerted social interaction. The classification and ontological constitution of genders, bodies, desires, *and technological artefacts* are intelligible only insofar as they conform to heteronormativity.

Third, in the ontological constitution of artefacts, knowledge and practice are singularly important; there is nothing irreducibly material about heteronormative gendering and sexualization. This final secondary claim follows from the above argument regarding underdetermination and the limitations of obdurate materiality. The gendering and sexualization of technological artefacts and the superordination of heterosexuality that characterizes both do not derive determinately from the artefact's material structure. This is not to suggest a form of idealism (see Bloor, 1996) or to entirely elide the 'purely' physical:

> It is profoundly mistaken to imagine that natural knowledge is not a part of the social order, just as it is mistaken to imagine that technical and material practices are not a part of the social order. (Barnes, 1988: 46)

Moreover, this claim is not intended to suggest an unlimited potential for social practices. Rather, it is intended to demonstrate the necessarily social character of all classificatory systems (see Barnes, Bloor, & Henry, 1996).

In substantiating the three secondary claims—and with them the primary claim—I evidence a series of arguments developed earlier in this chapter. I provide further empirical data to support my conceptualization of artefact ontology as a social institution, demonstrate that artefacts are underdetermined by their materiality, and prove that sexuality is a necessary component of social research into technology, and an imperative for feminist technology studies in particular.

The case material is structured into three sections, each of which contains one empirical component of this argument. First, I document and analyze the manner in which the agent-artefact relationship is understood as one of domination and submission. Second, I provide evidence that the agent-artefact relationship is consistently built upon tropes of romance characterized by conventional heteronormativity. Last, I address and provide data that illustrates the role of idealized heterosexuality in the constitution of artefact ontology by examining women's experiences and narratives of motorcycling. These three facets of my study document the fashion in which the motorcycle is understood as a submissive heterosexual feminine entity vis-à-vis the dominant heterosexual masculine rider. My analysis explicates that the heterosexual matrix is fundamentally involved in the ontological constitution of artefacts.

4.4.4 Domination / Submission

Above I note the pervasive and pivotal association of masculinity with domination, aggressiveness, and activity, and that of femininity with subordination, submissiveness, and passivity. This claim is based upon a longstanding cache of gender studies research, as well as investigations that have dealt specifically with gender, sexuality, and Latin America; it is a claim that has been substantiated with considerable empirical data, and while the dichotomy is a simplification of heterogeneous social dynamics[87], it is nevertheless an important facet of the ubiquitous gender binary.

My empirical investigation indicates the manner in which the domination/submission dichotomy plays out in agent-artefact interaction. Accounts of motorcycle use consistently emphasize the dominant character of the rider in contrast with the submissive character of the machine. In various modes, the relationship between human and machine is one that conforms to the domination/submission divide. Domination over the machine is articulated as a necessary component of the visceral feeling of control, rider skill, compatibility between the rider and the motorcycle, and safety. The end effect of these various narratives of domination is to constitute ontologically the artefact as an object *to be dominated* and as one that is *submissive to the rider*. This ontological property is of paramount importance in the heteronormative gendering and sexualization of the motorcycle.

[87] Recall from Chapter Three that mutual susceptibility and sanctioning are not perfect: individual idiosyncrasies and consensus 'drift' are inevitable in collective practice.

First, domination is characterized as a central aspect of riding the motorcycle, and is described as a visceral feeling of control. A sense of empowerment is also directly linked with the practice of domination over the machine. For many participants, the experience of riding a motorcycle was unquestionably inseparable from feelings of control and domination. In responding to my asking them to describe the experience of riding, many participants noted that to ride is to control:

> "… it's a feeling that only someone who rides a bike can describe, right? A very, very nice feeling. It's not a bike, let's say a high-cc bike, it's not like with a small bike, riding, no. It's something very different, feeling that you control, dominate that machine, right?" (CR-12, female, BMW C 1200)

> "…the bike is an incredible feeling, I mean, domination…" (CR-30, male, Yamaha YZFR 600)

For both CR-12 and CR-30, there is no experiential distance between riding a motorcycle and dominating the artefact. In their accounts of motorcycling and particularly in their descriptions of the pleasure of riding, the artefact is understood necessarily as an object that provides a feeling of control. CR-12, a middle-aged professional, exuberantly discussed the motorcycle as an object over which she had complete control, and which provided a sense of self-confidence and empowerment not otherwise accessible to her. CR-30, a sportsbike motorcyclist, instead referred to the pleasure of harnessing the powerful engine of his Yamaha and travelling at very high speeds; the visceral feeling of the engine's power and the speed of the ride are for him experienced as phenomena of control, even if riding a sportsbike is often about being 'on the edge' of control. Comparably, other riders articulated the feeling of domination as empowering. Numerous participants—in responding to my asking them if any unique experiences characterize riding a motorcycle—noted that controlling a large machine—for them the motorcycle—provided a sense of power and mastery over technology. Again, these feelings of power are articulated through the discourse of control and domination:

> "… the first impression that [the motorcycle] gave me was that I could, I could drive, that I could have control of something totally mine, I mean, without having anybody interfere in that, in that aspect, just the machine and me, nothing more, and the machine was obviously going to respond to my commands." (CR-34, male, KTM Adventure 990)

> "You, you, you feel its power, the engine's torque when it's pulling, it gives you like control of the situation, right? So you say, 'I'm the one in charge here, [*laughter*] motorcycle, go, come on'." (CR-20, male, BMW GS Adventure 1200)

CR-34 and CR-20 both own double-purpose motorcycles capable of off-road enduro driving, and both enjoy this characteristic of their motorcycles. CR-34 often participates in off-road driving with friends, and noted during the interview that control over the machine empowered him to tackle difficult mountainous terrains—thus giving him a sense of control over nature as well. CR-20 similarly noted the machine's responsiveness to commands, and idealized the motorcyclist's position as one of authority. Previous work on gender and technology has documented similar feelings of power and control (see Faulkner, 2000; Kleif & Faulkner, 2003). These studies further substantiate my claim that domination is oftentimes a fundamental component of agent-artefact interaction. Here, domination over the machine is explicit; control is equated with empowerment; the machine is submissive to the dominant rider.

Domination is also construed as a necessary component of riding skill. The participants articulated a broad set of qualities that 'make a good rider', often characterizing the ideal rider as possessing both technical and social skills associated with riding and interacting with other motorcyclists[88]. The participants often noted skill, riding ability, and technique as crucial components of their judgment of other riders. Sometimes, these qualities were articulated in the language of domination and submission. Responding to a question about rider skill, CR-22 argued that a central characteristic of a good rider is:

> "Calmness when it comes to driving, maintaining your nerve, not letting the machine take you over…" (CR-22, male, Honda Goldwing 1832)

While CR-22 noted that physical dexterity and technical know-how were important components in normatively judging a motorcyclist, he valued composure about all else. The unflappable motorcyclist is one whose control of the machine is absolute, one who never occupies the subordinate position in the agent-artefact relationship. Skill is associated with the ability to control and dominate the artefact. Lack of skill is associated with losing the dominant position and becoming subordinate to the machine. Again, the domination/submission relationship is present. Here, this relation forms the basis upon which rider ability is gauged.

[88] For a study on constructions of the relationship between 'technical' and 'social' skills, see Faulkner, 2007.

Other participants expressed this notion of rider ability in terms of compatibility with the machine, and likewise drew direct links to domination and submission. Compatibility between the rider and the motorcycle—otherwise articulated as the *proper* relationship between agent and artefact—was characterized by the participants as conforming to the dominant rider/submissive machine dichotomy. A good interaction was primarily a function of domination:

> "I really wouldn't like a bike that makes me feel I can't dominate it. Because at high speeds having an accident is not very pleasant." (CR-10, male, Yamaha XT 375)

> "…once I sat on [a bike] and I felt it very stiff. Like I'm saying, you have to, I mean, you have to be the one that dominates the bike, not the bike that dominates you." (CR-23, female, Kymco Hipster 150)

Both CR-10 and CR-23 were discussing the importance of control and domination over the motorcycle when considering what machine to purchase and ride. They articulated their concern regarding compatibility as a matter of unquestionable domination by the rider. Compatibility featured prominently in many of the interviews as a central facet of agent-artefact interaction. I return to this topic in greater detail in Chapter Six in relation to symbiotic embodied experiences. However, even when this compatibility was articulated as a more reciprocal, equitable relationship, control differentials were still present:

> "… if someone wants to buy a bike and for it to be in agreement I think that you have to know how to dominate the bike." (CR-23, female, Kymco Hipster 150)

> "It's simply where there is that symbiosis, that you feel it's part of you and that you can dominate, that you can dominate the motorcycle, right? That it doesn't dominate you." (CR-34, male, KTM Adventure 990)

Although CR-23 and CR-34 speak of 'agreement' and 'symbiosis', they emphasize the importance of rider domination over the motorcycle. As the owner and manager of a motorcycle dealership, CR-34 often has to recommend machines to individuals; he noted that compatibility is crucially important, both with regard to issues of personality and the physical demands of a specific machine. The former is a concern of synchronicity while the latter demands absolute rider control. His quotation stresses the importance of avoiding subordination to the technological artefact, as many of the participants articulated domination and subordination as relational concepts or a zero-sum situation. These various

quotations further evidence the ubiquity of control as a component of the motorcycle's ontology as an entity to be controlled and which stands subordinated to the rider.

Finally, domination is a critical element in riding safety. Numerous participants discussed the importance of safety when riding; even those motorcyclists whose behaviour is commonly regarded as reckless discussed safety with me. The topic is one of paramount concern to motorcyclists. A subset of the participants discussed the relationship between domination and safe riding; oftentimes, domination over the motorcycle was characterized as a prerequisite of safe riding. In narrating an experiece of displeasure, CR-01 said:

> "Another thing that's important is once you get experience you, eh, eh, you, you lose, eh, you know, you start to feel very comfortable with it, you don't feel that you're going to fall down, you know, you know how to react, how the motorcycle reacts, how to break, what to do in an emergency you know, it's a much more pleasurable thing you know. You, you feel that you have much more control of the, you know, control of the vehicle, which is very important, the whole concept of, of knowing how the thing reacts, you know, how you can control that, you know. To, to do what you want it to do and also to be safer and to be, and you know to enjoy it more." (CR-01, male, BMW R 1200)[89]

CR-01 notes that control over the machine is a necessary component of safe riding. Moreover, he argues that increased knowledge about and domination over the machine's behaviour results in more pleasurable experiences on the road[90]. His most distressing moment on a motorcycle occurred when he experienced a loss of control. Travelling to San José, his visor clouded with condensation and he lost almost all visibility. His inability to see led to a loss of confidence as he became less empowered over the motorcycle, and he was forced to stop the machine gradually and resolve the problem. To varying degrees, other participants noted the necessity of controlling the motorcycle in order to fully enjoy the ride through safe practice. Countless guides on motorcycle riding emphasize the importance of safety for enjoying motorcycling (Hough, 2000; Motorcycling Safety Foundation, 2005; Parks, 2003).

These four facets of domination—empowerment, skill, compatibility, and safety—evidence the ubiquity of and emphasis given to control. The motorcyclists I interviewed overwhelmingly characterized the motorcycle as an object to be controlled by and

[89] This interview was originally given in English, so it was not necessary to translate the transcription of this quotation.
[90] C.f. Barnes' work on training and competent users (1982). Here competence is linked to domination and safety.

subordinated to the rider. While they sometimes employed a discourse of symbiosis with the machine—a topic I address in Chapter Six—the domination/submission dichotomy is centrally involved in agent-artefact interaction. Symbiosis is a pervasive discourse, but is not as common a facet of practice as domination over the machine, as I discovered through my ethnographic sessions. As I develop below, these empirical observations play central roles in my investigation of the heteronormative gendering and sexualization of technological artefacts.

4.4.5 Tropes of romance

As I have begun to argue, the agent-artefact relationship is one marked by the prominent social valuation of heterosexuality in Latin America. The domination/submission dichotomy forms one fundamental component of this relationship. My empirical research further documents the heteronormative gendering and sexualization of technological artefacts by exploring the role played by models and patterns of heterosexual love.

My empirical investigation details the interview participants' pervasive reliance upon tropes of romance in articulating their use of the motorcycle[91]. A conventional notion of machinic passion[92]—consistently expressed as romantic love—saturates the interviews. The basic metaphor of love is present in many of the driver's accounts, and forms the basis upon which more elaborate tropes of romance are articulated. Other participants specifically discuss their relationship to the motorcycle in terms of traditional romantic practices, such as courtship, engagement, and marriage. These narratives often directly correspond to a heterosexual ideal; the motorcyclist portrays himself as a man searching for an appropriate female partner with whom to fall in love. This female lover is consistently portrayed as a *submissive* partner, again reiterating the importance of the dominant/submissive divide in crafting the gendered and sexualized relationship between agent and artefact. Additionally, the close physical relationship between rider and machine—a central facet of motorcycling—is repeatedly portrayed as an expression of intimacy and love. Touch corresponds to caress; cleaning is equated with care. These various components together constitute the recurrent tropes of romance with which the motorcycle is ontologically constituted as a gendered and sexualized partner in relation to the rider.

[91] For a discussion regarding the importance of metaphors in language, cognition, and social life, see Lakoff & Johnson, 2003 [1980].
[92] See also Law, 1998.

The interview participants consistently used the notion of love as a metaphor in describing their relationship with the motorcycle[93]. In this most basic iteration of a romantic trope, the participants used love as a hyperbolic tool when they needed to articulate their enjoyment of motorcycling in unequivocal terms. In discussing their motorcycles, two participants stated:

> "I'm fascinated with my bike, right? I am in love with her." (CR-19, female, Honda Shadow 600)[94]

> "I am insanely in love with that bike." (CR-21, male, Harley-Davidson Sportster 883)

These two motorcyclists intended to establish in near-absolute terms their passion for the machines they drove. Love for the machine was not only a recurrent theme, it also formed the foundation upon which the ideal agent-artefact relationship existed. Numerous participants described the ideal rider as one who dedicated significant time to caring for the machine, and one who was passionately committed to the motorcycle. Thus the normative ideal corresponded to a ubiquitous notion of love. Similarly, participants consistently described love as a standard characteristic of a biker:

> "… he's really very much in love, the motorcyclist is a lover." (CR-11, male, unspecified BMW)

> "The love for bike, because it's love that you feel. Everyone in their different way." (CR-22, male, Honda Goldwing 1832)

Being a motorcyclist means being in love. Here, love is articulated as a component of individual emotion and practice. Possessing a level of machinic enjoyment on a par with human love is a fundamental facet of 'what it is' to be a motorcyclist. Furthermore, my participants frequently discussed their relationships with the motorcycle as conforming to conventional notions of romance. Commonly, these rested upon the concept of love-at-first-sight:

> "My first experience was love-at-first-sight. When I was young." (CR-14, male, BMW GS Adventure 1200)

[93] For a collection of accounts addressing the emotional relationships between humans and machines, see Turkle, 2007.

[94] Arguably, this is an instance of female-female desire, an abject modality of desire as discussed by Butler (1999 [1990]). See sub-sections 4.4.6 and 4.4.7.

> "I wasn't looking for a very expensive bike, but when I saw a bike there that I liked a lot, I fell in love with the bike and spent three times what I had thought I'd spend on a bike." (CR-18, male, BMW GS 1200)

Love-at-first-sight functioned as the basis for an idealized relationship to the machine in a similar manner to that in which it influences conventional notions of love and romance. As is evident from these various quotations, love is a pervasive theme in the participants' narratives. These basic notions of romance constitute the foundation of more complex accounts of the agent-artefact relationship.

The hyperbolic use of love during the interviews of course is not sufficient to evidence the presence of tropes of romance. It serves even less when considering the question of heteronormativity as it relates to these tropes. However, participants further elaborated their love for the motorcycle and explicitly compared it to conventional romantic practices. As such, many of the accounts given by participants make use of what I label tropes of romance. For instance, the agent-artefact relationship is commonly described in terms of courtship, engagement, and marriage:

> "That's how I started with motorcycling. It was a courtship with a waiting period of 10 years that I couldn't have it, only admire it." (CR-05, male, BMW RT 1200)

> "I think it has to do with chemistry. It's like a courtship. You go out with a girl that you don't like very much, you say, 'no, I don't like this girl very much.' The moment you find that girl, who's going to be, who got rid of all your expectations, she becomes automatically your wife, right?... I think it's the same with motorcycling. The moment you find the brand, the model, the style of bike that fits with your needs, that's where you stay." (CR-20, male, GS Adventure 1200)

CR-05 and CR-20 describe their relationship to motorcycling and motorcycles in the language of traditional romantic practices. After his first experiences in motorcycling, CR-05 was unable to own a motorcycle for 10 years because of family pressure and financial constraints. During that time, his passion for the sport and the technologies did not relent, and was eventually satisfied when he began riding again. For CR-05, waiting and pining were prologue to satisfaction in motorcycling as courtship precedes commitment in marriage. Similarly, CR-20 directly compares finding a motorcycle to dating; the machine is explicitly compared to a girlfriend, a fiancée, and a wife. An optimal agent-artefact pairing is one established through machinic 'dating' that results in technological marriage. Clearly, the romantic tropes employed in characterizing the agent-artefact relationship are constituted in relation to an ideal of heterosexual love. That conventional heterosexual institutions such as

marriage appear so centrally in motorcyclists' accounts of the agent-artefact relationship lends further credence to my argument that tropes of romance are indicative of a heteronormative imperative in the ontological constitution of technological artefacts.

The interviews further reveal that when tropes of romances are employed to describe the agent-artefact relationship, the motorcycle is constituted as a submissive partner. The relationship between rider and machine is frequently idealized because of the subordinate and grateful character of the motorcycle. Often, the machine is compared directly to the rider's female partner as an example to be followed:

> "She doesn't fail me, doesn't bother me, doesn't nag me, no." (CR-20, male, BMW GS Adventure 1200)
>
> "… I've had bad experiences with other women because, 'You give more to the bike.' [laughter] I tell them, 'Well, the bike doesn't complain,' I say to them. [laughter] 'I can invest in the bike and it doesn't bother me and it likes what I put on it and it's grateful.'" (CR-29, male, Suzuki GSXR 750)
>
> "… the bike doesn't talk back, right? It doesn't complain…" (CR-31, male, Kawasaki Ninja ZX69 636)

The motorcycle is a compliant and subordinate partner. CR-20, who earlier noted that finding a motorcycle is like dating women, argues that the motorcycle as partner is preferable to women insofar as it does not talk back. Thus the end result of machinic dating is a submissive partner. CR-29 and CR-31 are both sportsbike owners currently in relationships with girlfriends. They spend considerable amounts of time tuning, cleaning, detailing, and riding their motorcycles, often to the chagrin of their partners. These two participants feel reciprocation from their machines insofar as their displays of affection—in the form of care for the motorcycle—are never challenged by the artefact; it is passive and compliant. Even instances of machinic failure (mechanical breakdown) are understood as opportunities to care for the motorcycle. In sub-section 4.4.4, I argue that domination and submission characterize the agent-artefact relationship in motorcycling. Here my research further illustrates the ontological constitution of the motorcycle as submissive to the rider. The tropes of romance I document above constitute a relationship between the rider and the machine that conforms to conventional heterosexual notions of love and romance. Crucially, the motorcycle is not simply understood as a partner, it is understood as a *submissive* and *dominated* partner, and as such compliant with patterns of heteronormativity in Latin America.

Finally, physical intimacy played a considerable role in the participants' use of romantic tropes. Comparisons between motorcycles and partners extend beyond the emotional relationship between rider and machine; motorcyclists also cast their physical interactions with the technological artefact in terms of love and romance. Their physical practices are characterized by those concepts and patterns that distinguish the emotional relationship between agent and artefact. One particularly salient practice with regard to tropes of romance is cleaning the motorcycle. The participants described the practice of carefully cleaning the machine as a core component of caring for and enjoying time with the motorcycle:

> "… pulling out the hose, getting the soap, cleaning the bike, is as nice as riding the bike. I mean, it's enjoying the bike, it's caring for her, loving her." (CR-26, male, Honda Shadow 500)

Physical interaction is a hugely important facet of motorcycling, both on and off the road. The ubiquity with which accounts of touch and care appear in the interviews signals a fundamental association between human touch and machinic intimacy. Much as other participants, CR-26 detailed his weekly practice of thoroughly cleaning his motorcycle, and much as other participants, he noted the pleasure with which he approaches the task. Dismantling the motorcycle, using different brushes and cleaning agents, checking every crevice of the machine's structure, and finally reassembling the object are all processes that involve intimate tactile relationships between agent and artefact. Touch and care are critical phenomena in motorcycling. CR-26 went so far as to note that on rainy days, he might clean his motorcycle instead of riding it, and derive the same pleasure from the former as he would from the latter. Previous work on masculinities and technology—also focused on motorcycles—has unambiguously demonstrated the significance of embodied interaction (see Mellström, 2004). My own empirical work further evidences the importance of touch, and contributes an understanding of this interaction as founded upon concepts of heteronormative love.

The four empirical themes discussed here—basic metaphors of love, comparisons with heteronormative relationships, the subordination of the machine, and physical interaction—are constitutive of tropes of romance. Motorcyclists consistently portray their relationship to the machine as one conforming to romantic love. Moreover, these portrayals themselves conform to a heterosexual ideal. Thus agent-artefact interaction is often founded upon heteronormative conventions of love and romance.

4.4.6 Idealized heterosexuality and presumed lesbianism

The agent-artefact relationship is characterized furthermore by the common presumption of lesbianism for women who ride motorcycles. Consistently, women participants noted explicit and implicit suggestions regarding their sexuality, almost all of which portrayed the female motorcyclist as masculine[95] and lesbian. Additionally, the participants reported the purported contradiction between women motorcyclists and heteronormatively femininine women[96]—often characterized as conforming to the needs of the family and expressing overt heterosexual desire. These contradictions further evidence my claims about the gendered and sexualized agent-artefact relationship. Finally, almost all of the women participants in some way attempted to emphasize their heterosexuality during the interviews, by making reference to some of the idealized conventions and institutions of heteronormative femininity—marriage, children, and housework, for instance. These motorcyclists felt compelled to distinguish themselves actively from stereotypes of lesbianism by articulating an exaggerated portrait of their heterosexuality. In doing so, they further reify the institutions of heteronormativity, as well as give proof that the rider-machine relationship is characterized by these patterns of heteronormativity.

A majority of my participants—both men and women—noted that women motorcyclists were subject to pervasive and discriminatory stereotypes of lesbianism[97], originating from both within and outside the motorcycling community. Motorcycling—understood as the acts of owning and driving a motorcycle—is conventionally portrayed as an active, aggressive practice and is gendered masculine. As I note above, the notion of dominating the motorcycle corresponds to broad categorizations and markers of heteronormative masculinities; moreover, the agent-artefact relationship is defined and understood through tropes of romance correlating with idealized heterosexuality. The rider is consistently portrayed as heterosexual and masculine. The result for women riders is disparagement:

[95] For a comprehensive study of masculinity-without-men, see Halberstam, 1998.
[96] Faulkner addresses this phenomenon in relation to women engineers through her notion of 'gender in/authenticity' (2007).
[97] Only one of my nine female participants is lesbian. The remaining participants either explicitly defined themselves as heterosexual, or did so implicitly through reference to boyfriends and/or husbands. While the latter is not a precise indicator, it is as accurate a proxy for sexuality as I documented with the interviews. Ultimately, the stereotype and presumption of lesbianism initially affects all women riders equally.

> "So to me it seems that there exists a stereotype that, if you ride a bike it's, on one hand, because you like things that are masculine, right? That's not necessarily seen well, or that you're a lesbian, right?" (CR-04, female, Honda Rebel 250)

> "… a lot of doubts are created or whatever, in terms of your sexuality, right?" (CR-06, female, Harley-Davidson Sportster 883)

> "They also, they also say, that they're a bunch of lesbians, right?" (CR-06, female, Harley-Davidson Sportster 883)

This data further evidences my claim that the agent-artefact relationship is defined as one in which the rider is categorized as heteronormatively masculine in relation to the machine's heteronormative femininity. Presumed lesbianism is the most recurrent generalization regarding women motorcyclists. While the quotations above represent replies by women, my male participants similarly noted these stereotypes and their negative consequences. The frequency with which the women participants encountered this assumption evidences the fundamentally gendered and sexualized ontology of the motorcycle.

Stereotypes about women motorcyclists also appeared in the form of contradictions. The presumed heteronormative masculinity of the rider results in a series of inconsistencies for women motorcyclists. A common disparity results from the conventional dress of motorcyclists, which often consists of heavy jackets and trousers, boots, gloves, and a full-face helmet. These often hide the particularities of the body, making it almost impossible to identify distinguishing features. While the body is in fact 'unsexed' as such, the presumption of masculinity persists. When the rider is in fact a woman, a contradiction ensues:

> "… if you arrive at a gas station, because of the way I am dressed people don't know that I'm a woman. So generally they speak in masculine. Let's say, 'dude', something like that, so when I take my helmet off they realize so well, it's, 'oh, what a nice bike, it's not common, don't you get scared riding a bike like that? How much did it cost?'" (CR-04, female, Honda Rebel 250)

CR-04 must negotiate a stereotype that portrays her as a constant contradiction within motorcycling. She is a woman engaged in a 'masculine' practice and wearing 'masculine' clothing[98]. This form of inconsistency was reported by several of the interview participants:

> "In this convention, a reporter when he saw that I was putting on makeup and fixing myself up, said, terrified, 'look, it's a woman and she has makeup!" I don't know what he thought of women on bikes but he was scared that I was putting on makeup…" (CR-12, female, BMW C 1200)

[98] Much could be said here regarding drag kings and 'masculine' clothing. See Halberstam, 1998.

In this example, the contradiction extends beyond simply CR-12's physical features. The reporter is shocked by her makeup as well. As such, while the presence of a woman rider is sufficient cause for surprise, he also stresses the significance of her also engaging in what is understood conventionally as a feminine practice—wearing makeup. CR-12 suggests that perhaps the reporter assumed that women motorcyclists lacked the femininity to continue wearing makeup, and were thus 'more masculine' than non-rider women. Similarly, the interviews revealed a strong contradiction between the conventional practices of heteronormative femininities and women motorcyclists. Specifically, the issue of family:

> "If I imagine, those women are very independent women, professionals, they're not, they're not housewives…" (CR-10, male, Yamaha XY 375)

CR-10 further argues that in order for a woman to ride a motorcycle and enjoy it in a similar manner to a man, she must possess distinctively masculine characteristics such as independence and activeness. Being a housewife is contradictory to these qualities, as symbolically it represents the apex of heteronormative femininity (and thus, also passivity). CR-10 provides further evidence of the tension in place between motorcycling and heteronormative femininity. These various contradictions illustrate the heterosexual ideal that permeates the practice of motorcycling, with considerable ramifications for the ontological constitution of the motorcycle[99].

Finally, many of the women participants expressly emphasized both their femininities and heterosexuality, and discussed the manner in which they articulated both while motorcycling. The emphasis placed upon heteronormative femininities is indicative of the presumption of lesbianism I discuss above, but it also illustrates the pervasiveness of heteronormativity more broadly. In evaluating themselves as motorcyclists, many of the women actively and vehemently expressed their continuing sense of femininity:

> "No, you don't lose your femininity, I mean, when I rode bikes I didn't lose my femininity. In fact, I looked for pretty things that showed, I would put makeup on and do my hair and everything and from far away you could see it was a woman who was driving… They never confused me with a man because I always wore visible things and never lost a woman's femininity." (CR-23, female, Kymco Hipster 150)

[99] As well, of course, for the subject, a topic I address in Chapter Five.

> "… you don't lose your womanhood. Being delicate. At least I haven't lost it and am not going to lose it because of riding a bike on the street. No. I will always be feminine." (CR-16, female, Suzuki Intruder 800)

These two quotations illustrate several important points. For both of these women, and almost all of my women participants, 'womanhood' was indistinct from femininity. Moreover, overt displays of the latter were common tactics in combating assumptions and accusations of lesbianism. Finally, the interviews revealed the significance many of these motorcyclists placed upon actively retaining their sense of femininity. Thus the women in the study use indicators of heteronormative femininities strategically in order to distance themselves from the presumption of homosexuality they encounter by riding the motorcycle. Additionally, they further reify the status of the rider as heteronormatively masculine. The participants further emphasized their 'womanhood' by resorting to thoroughly heteronormative discourse:

> "I was really struck by [a newspaper story on the Black Widows] because it insisted, I mean, it insisted a lot in saying that they were women. And what are women like? Well they have a husband and kids, that's what women are like, right?" (CR-04, female, Honda Rebel 250)

> "… I am a women in all her, with all of her stages… I'm a mother, I'm head of our household, and I have kids…" (CR-07, female, Harley-Davidson Sportster 883)

As I note above, femininities are at their apex with motherhood, and these two participants explicitly evidence the point. The quotations provide one final illustration of the incompatibility existent between motorcycling and heteronormative femininities.

The empirical data on presumed lesbianism and emphasized heterosexuality indicates that the agent-artefact relationship operates along and reproduces heteronormative patterns, with the rider characterized by heteronormative masculinity. When combined with the earlier work on the domination/submission dichotomy and tropes of romance, the evidence is compelling; the ontological constitution of the technological artefact renders the machine as heteronormatively feminine. As I argue below, this claim is of paramount importance when considering the social basis for artefact ontology, as well as for addressing questions of the gendering and sexualization of technological artefacts.

4.4.7 Some implications

I sought with this case material to substantiate one claim: *technological artefacts are gendered and sexualized in heteronormative patterns*. I provided evidence for and analytically established my claim that artefacts are made intelligible as gender and sexuality are made intelligible in Latin America. Moreover, I verified Landström's claim to the importance of heteronormativity in feminist technology studies (2007)[100]. Finally, I proffered substantial data to evidence the fundamentally bootstrapped and underdetermined character of technological artefacts. Here I recapitulate the major points of my argument and draw attention to the applicability and usefulness of a sociophilosophical understanding of technological artefacts.

The social constitution of artefact ontology implies that technological artefacts are made intelligible *qua* artefacts in the same manner as gender and sexuality are made intelligible. The phenomena are functions of a common set of knowledge and practices. The empirical investigation demonstrates that motorcycles are constituted as subordinate entities to the rider's domination, just as gender and sexuality are made intelligible within a dichotomy of domination and submission. The rider and machine are involved in a relationship often characterized using tropes of heteronormative love, lending further credence to my claim that the machine is construed as heteronormatively feminine. Finally, women motorcyclists often have to manage stereotypes of lesbianism, evidencing my claim that riders are understood as heteronormatively masculine. When analyzed in conjunction, these three empirical components demonstrate a clear correlation between gender, sexuality, and artefact ontology through the agent-artefact relationship.

Butler's heterosexual matrix is useful in analyzing and explicating the heteronormative constitution of the motorcycle's ontology. The heterosexual matrix is a distribution of knowledge established and maintained by collective practice, and is fundamentally involved in categorization. An analysis of technological artefacts that uses both PTSI and the heterosexual matrix considers the latter to be a particular social order that contributes to the process of concept application addressed by the former. Technological artefacts are understood and categorized by collective social practice; the heterosexual matrix constrains this practice in specific manners. Just as gender and sexuality are classified and made intelligible in a manner congruent with the heterosexual matrix, technological artefacts

[100] There exist few reasons to suspect sexuality is relevant only for the study of motorcycles.

comply with the conceptual framework of the matrix. The ontological modality I here address—artefact as heteronormatively feminine—can be understood as a function of Butler's matrix.

Importantly, this ontology is fundamentally underdetermined by the physical properties of the machine. The heteronormative gendering and sexualization of the artefact is not reducible to metal, plastic, and leather. None of the participants referred to physical properties as determinant of the agent-artefact relationship. While weight commonly appeared as a deterrent to women riding larger motorcycles, the participants always noted that lighter machines of equal status exist. No other 'purely' physical consideration emerged during the interviews as a causal factor for the phenomena I discuss above. The heteronormative ontology of the motorcycle is a product of knowledge and social practice.

4.5 The bootstrapped artefact

Artefact ontology is a social institution, and all technological artefacts are artificial kinds. This I empirically and analytically demonstrated above. Here I briefly recapitulate two critical arguments: first, that of the social character of artefact ontology; second, that of material underdetermination. I then proceed to a discussion of communities and artefacts. Last, I address the relationships between technological artefacts and social orders.

Technological artefacts *qua* technological artefacts are functions of social practice. Outwith the concerted practices of mutually-susceptible agents, artefacts (clearly) maintain their materiality, but do not posses their ontology as we understand it[101]. Artefact ontology—the property of being-an-artefact—is necessarily a product of social practices. This, along with all artefacts' obdurate materiality, suffices to analyze technological artefacts as artificial kinds.

A consequence of this conceptualization is material underdetermination. While technological artefacts exist in space and time, their materiality is not a sufficient condition for artefact ontology (see Houkes & Meijers, 2006; Schyfter, 2009). Plastic, leather, and metal do not unproblematically determine the ontology of a motorcycle. While the material component of

[101] Put yet a different way: I do not deny materiality, but I deny materiality a technological ontology outside of society.

technological artefacts is necessarily involved in the problem of ontology, it is in social interaction that all artefacts' ontologies are 'born' and maintained.

Consequently, the focus of sociological investigations of technology must be collective practice. Communities of agents are ultimately responsible for artefact ontology; it is through sustained, mutually-intelligible, and mutually-susceptible interaction that collectives produce and maintain all social institutions (Barnes, 1983; Kusch, 1999), including that of artefact ontology. Not only does this argument follow from my earlier discussion of the conventional and collectively-constituted character of artefact ontology, it is concomitant of the Strong Programme's communitarian epistemology—a topic I address in Chapter Three. Communities define artefacts. Similarly, artefacts commonly operate as a focal point for social interaction, and can define the boundaries of communities. This dialectical relationship does not invalidate any argument concerning the social character of artefact ontology. It rather reinforces my claim that technological artefacts and collectives are fundamentally interrelated phenomena.

As products of communities, technological artefacts are necessarily subject to the contingencies and vicissitudes of those communities within which they are situated. Artefact ontology is—as are all social institutions—conventional. The dominant beliefs and practice of a community are fundamentally involved in the social constitution of artefacts' ontologies. Moreover, as I note in my discussion of finitism and ontology above, ontologies cannot be disassociated. A community's understanding of gender and sexuality necessarily characterizes its understanding of artefact ontologies. Although articulated differently here, it is upon this fundamental claim that feminist technology studies has developed its breadth of research. The social order defines the character of artefact ontologies—in this case the order under examination is that of gender and sexuality. The constraints of artefact intelligibility are those same constraints that specify acceptable genders, bodies, and desires.

The result of these various arguments is to establish a communitarian understanding of technological artefacts. Artefacts are entirely dependent upon society. As writes Foucault:

> … the object does not await in limbo the order that will free it and enable it to become embodied in a visible and prolix objectivity; it does not pre-exist itself, held

> back by some obstacle at the first edges of light. It exists under the positive conditions of a complex group of relations. (Foucault, 1972 [1969]: 45)[102]

All technological artefacts are bootstrapped; their ontology is a matter of productive social practice.

Importantly, this ontological bootstrapping is reliant upon other ontologies in the social constellation. The motorcycle is heteronormatively feminine vis-à-vis the heteronormatively masculine rider. Without the gendered and sexualized subject, the gendered and sexualized artefact cannot exist as such. To resolve fully the question concerning artefact ontologies, an analysis of subject positions is demanded.

[102] Foucault is referring here to objects of discursive formations, not physical entities. Nevertheless, the quotation is of relevance to my work. I discuss the links between knowledge and ontologies in Chapter Seven.

Chapter Five: Subjects

In Chapter Four, I interrogate the manners and modalities in which artefacts are rendered intelligible in social life. Crucially, my enquiry demonstrated that intelligible artefact ontologies are linked to specific subjects—the feminine artefact is constituted in relation to the masculine rider. Consequently, a robust sociological study of technological artefacts requires an equally comprehensive understanding of subjects and subject positions. It is necessary to question subject ontology—the property of being-a-subject—and explore the manner in which it is rendered intelligible. This chapter develops a sociophilosophical approach to the question of subjects—one that emphasizes the collective origin of subjects—much as Chapter Four developed a similar conceptualization of technological artefacts and Chapter Six does for bodies. As I argue in detail in Chapter Seven, the sociology of technology cannot afford to privilege one component of this triad above the other two.

I put forward in this chapter a communitarian account of subjects and subjectivities with relevance for the sociology of technology and broader social theory. I argue that subjects can be analyzed much as I earlier discussed technological artefacts, and subject positions as I did artefact ontologies; that is, I argue that subjects are artificial kinds and subject positions are social-kind statuses—social institutions. My communitarian account stands opposed to individualistic and essentialist descriptions of subjectivity. This thesis rejects any conceptualization of subjects and subjectivities that analyzes these as individualistic phenomena. These claims are explored in detail below, while the usefulness of such a sociophilosophical analysis is discussed both in the latter half of this chapter and in Chapters Seven and Eight.

This chapter also explores the reticulations between age, ageing, and technological artefacts. The case material that constitutes the latter half of the chapter documents and explicates the various relationships between masculinities, age, and technology in Latin America, and engages directly with social studies of age and ageing. The strands of argumentation in my empirical study of ageing and technology advance the analysis that precedes them, and contribute substantially to various disciplines of research.

Before proceeding with the argument, a delineation of concepts is both prudent and necessary. Much like my earlier distinction between artefacts and spatio-temporal entities, a

careful distinction must be made here between the physical, living, breathing human being and the socially-situated subject. For the purposes of this analysis, *individuals* are the physical substrate, the living entities that can be identified empirically; *subjects* are individuals with social positions, responsibilities, and privileges. That is, subjects are individuals embedded in social interaction. *Subject positions*, or *subjectivities*[103], are those statuses to which subjects are held accountable[104]. For instance, the subject position 'Costa Rican' is associated with the subject 'Costa Rican citizen'; the latter exists in space and time, the former does not. These delimitations can be summarized as follows: individuals are socially-isolated human beings; subjects are individuals engaged in social practice; all subjects are defined by a multitude of specific subject positions.

This chapter begins with a series of fundamental considerations underlying my exploration of subjects and subjectivities. I proceed to argue and demonstrate that subjects are artificial kinds. Next, I engage with what is the most difficult component of this model of subjectivity: the 'I' and privileged first-person knowledge. Following this, I explore the interplay between masculinities, ageing, and technological artefacts. Finally, I note preliminary implications of my argument.

5.1 Subjectivity: Premises and postulates

I believe it both necessary and helpful to establish a set of parameters within which to develop an understanding of subjects. The question of subjectivities is fundamental to sociological studies of technological artefacts in relation to and as they operate within social life. Broadly speaking, the aim of this chapter is to explore subject formation and the character of subject positions; more specifically, I am working to develop a communitarian account of subjectivity. In doing so, I rely upon three fundamental premises, each of which motivated and characterizes this chapter's work. First, I hold that subjects are neither pre-existent nor stable. Second, I hold that subjects are amenable to analysis using the Performative Theory of Social Institutions. Third, I argue that subjects are necessarily unique phenomena in social analysis, and consequently require particular scrutiny.

[103] It is particularly important to note my use of 'subject position' and 'subjectivity' as equivalent terms. Moreover, properties such as identity, personhood, and status are all enabled by (but *not* equivalent to) subject positions (subjectivities). For a PTSI discussion of identity, see Soley Beltran, 2001.

[104] A similar acount of subject positions might derive from Schutz's use of 'ideal types' (1972 [1932]: Chapter 4, section D).

5.1.1 Subjects are neither pre-existent nor stable

The contingency of subjects and subjectivities is a foundational premise here, as well as a requisite point of departure for studies aiming to demonstrate the social bases of subjectivity. The proposition that subjectivities are contingent is by no means a revolutionary statement; philosopher Ian Hacking identifies contingency as the elementary premise of all studies in social constructionism (1999), and longstanding academic traditions have laboured and succeeded in demonstrating the variability of subject positions.

This tradition spans a range of academic disciplines, and includes seminal work in history (Foucault, 1991 [1975]), sociology (Goffman, 1990 [1959]), anthropology (Bourdieu, 2002 [1972]), and gender studies (de Beauvoir, 1997 [1949]). Through empirical work and comprehensive argumentation, the variability of subjectivities has been successfully established. Of particular importance has been work in gender studies, which since de Beauvoir's foundational volume has sought to reveal the social bases for the gendered subject. Perhaps more than any other discipline, gender studies has produced abundant arguments for the basic premise that subjectivity is not an essential or innate property of human beings (see e.g. Butler, 1999 [1990] and 1997). Similarly, Foucault's studies of prisons (1991 [1975]) and sexuality (1998 [1976] and 1990 [1984]) illustrate the relationships between subject positions and systems of productive power[105].

The premise that subjects are neither pre-existent nor stable carries with it a series of important consequences. First, any study of subjectivity must extend beyond the isolated agent; the individual is not a sufficient basis for the existence of subjectivity. While individuals (socially-isolated human beings) are pre-existent in relation to society, they are ontologically devoid of subjectivity. This claim is crucial to my discussion here, as it elucidates the importance of social interaction in bringing subjects into existence. Second, studies of subjectivity should aim at tracing the development and implications of subject positions, and *not* to discover the point of origin from which society first begat any single individual's subjectivity[106]. The sociologist rather is compelled to study the causes of any particular modality of subjectivity. Just as I asked of technological artefacts, I must ask of

[105] Also see Foucault, 1982.
[106] For compelling arguments regarding origins and subjectivity, see Foucault, 1977 and 1990 [1984].

subjects: by virtue of *what* are subjects made intelligible in the ways they are? What are the underlying causes[107]?

This thesis holds that these causes are fundamentally *social*. In parallel with Chapter Four, this chapter systematically demonstrates that subjectivity is a social institution comparable to artefact ontology, and that subjects are artificial kinds *analytically* comparable to technological artefacts.

5.1.2 Subjects are amenable to analysis using PTSI

I hold that the manifold questions regarding subjects and subjectivities can be addressed using the Performative Theory of Social Institutions. While the intent of this chapter is to demonstrate the capability of PTSI to address and resolve such questions, the ontology[108], epistemology, and formulation of these theoretical tools suggest that they are adept at analyzing subjectivities. As a social theory, PTSI has been used to address a multiplicity of topics, and has robustly and comprehensively rendered solutions to a variety of sociological questions[109]. The scope of PTSI's usage is indicative of the theory's success in sociological enquiry.

The Performative Theory of Social Institutions is a social theory of knowledge and cognition, and is premised upon questions of categorization and concept application. Subjects and subjectivities are social phenomena directly linked with concept application and classification; below, I demonstrate that collective attribution of a subject position is a process of communal concept application. While this approach is superficially similar to 'label theory' (McIntosh, 1968), the underlying explanation of social phenomena is significantly more nuanced and developed in the Strong Programme. The question of classification and subjectivity extends beyond metaphorical 'labels'—concepts and terms are

[107] Recall from Chapter Three: the Strong Programme is *causal*.
[108] In this instance, the term 'ontology' is being used as: "The science or study of being; that branch of metaphysics concerned with the nature or essence of being or existence." (From the Oxford English Dictionary)
[109] Researchers have deployed PTSI to address sociological issues such as training and socialization (Barnes, 1981a and 1982), power (Barnes, 1988), agency (Barnes, 2000), norms and rule-following (Bloor, 1997b), action and practice (Barnes, 2001b; Collins & Kusch, 1998), and knowledge communities (Kusch, 2002). Moreover, Barnes has contributed to social theory by engaging in a variety of salient debates, such as those surrounding the macro/micro divide and the structure/agency problem (2001a).

interrogated as components of a broader system of knowledge and practice, and do not unproblematically create or sustain subjectivities, as McIntosh's article suggests of 'labels'.

Finally, PTSI is capable of resolving two fundamental difficulties in the sociological study of subjects and subjectivities. First, this theory is successful in negotiating tensions between structure and agency. As I discuss in Chapter Three, PTSI's emphasis upon collective practice results in a framework capable of rendering clear the relationships between broad social phenomena, collectives, and single agents. In doing so, PTSI simplifies a number of problems in the study of subjectivity, including agency (Barnes, 2000 and 2001a) and the foundation and influence of social orders such as gender, sexuality, and age. These are dealt with in a fashion that incorporates the single agent as a causal factor of, as well as a subject affected by, social phenomena. Second, a Strong Programme approach to subjectivities resolves the apparent disjunction between knowledge and practice. PTSI successfully analyzes the manner in which knowledge (Kusch, 2002) and physical practice (Collins & Kusch, 1998) are responsive to and constitutive of communities, and studies their fundamental inseparability (Barnes, 2001b)[110].

5.1.3 Subjects are necessarily unique phenomena in social analysis

The examination of subjects and subjectivities poses a series of unique difficulties in sociological study, particularly when employing an analytic framework based upon issues of knowledge and cognition. During my exploration of technological artefacts in Chapter Four, the argument centred on entities external to the individual. A motorcycle is not a constitutive element of a human being; its physical structure is separable from that of the rider[111]; and the machine is not self-aware.

In studying the subject, researchers must take into account self-knowledge[112], a phenomenon fundamentally different from knowledge of external entities. Knowledge of the self—including experiences of the physical world, affect, thought, and memory—has traditionally

[110] I discuss knowledge and practice further in Chapters Six and Seven.
[111] For issues of human-technology hybridity, see Chapter Six and Schyfter, 2008.
[112] "Dasein is an entity which does not just occur among other entities. Rather it is ontically distinguished by the fact that, in its very Being, that Being is an *issue* for it." (Heidegger, 2005 [1927]: 32, emphasis original)

been understood as privileged; that is, self-knowledge is inaccessible by any other agent[113]. As such, it is not possible to rely on others' knowledge of an agent to discuss empirically or analytically that agent's self-knowledge. Moreover, a sociological study of self-knowledge finds itself at pains to demonstrate that a presumably isolated form of knowledge is social in character. It is this task that I take up in detail in section 5.3, where I demonstrate the social character of self-knowledge.

This issue, while seemingly abstract, is of central concern to sociological studies that make use of qualitative interview methodologies[114]. This form of enquiry inevitably produces data in the form of self-evaluation; the relationship between individual self-examination and collective social phenomena is crucial when analyzing empirical data. As such, this discussion has significant ramifications for sociological theory *and methodology*.

5.2 Subjects are A-kinds

Subjects are artificial kinds. The individual possesses an unquestionable materiality, but subjects require subject positions (subjectivities). The latter are attributed by and sustained within collectives; as such, subjectivities are wholly products of social practice. This chapter systematically demonstrates the applicability of PTSI to the question of subjects and subjectivities. In accomplishing this task, I aim to do more than simply extend the use of the Strong Programme. I contribute to broader social theory by demonstrating that subjects can only be studied and analyzed as products of knowledge and collective social practice. Without sufficient regard to the *social* basis for subjectivity, the analyst will render a limited portrayal of the subject.

At this point, it is vital to distinguish this approach as an analytic proposition, and not a metaphysical postulate. In stating and demonstrating that subjects are artificial kinds, I am making a theoretical and methodological argument. Subjects can be analyzed as artificial kinds in a *similar but not identical* manner to technological artefacts. Unlike approaches such as Actor-Network Theory (see e.g. Latour, 1991 and 1999), I do not subscribe to ontological relativism, and do not purport a fundamental equity between human and non-human entities. Technological artefacts, subjects, and bodies differ in a great variety of

[113] Schutz on the intended meaning of acts: "Constituted as it is within the unique stream of consciousness of each individual, *it is essentially inaccessible to every other individual*." (1972 [1932]: 99, emphasis original)
[114] This is a central concern for Schutz (1972 [1932]).

ways, and sociologists must recognize these differences and seek to explain them[115]. One fundamental distinction between artefacts and subjects has been addressed above—subjects possess self-knowledge, artefacts do not[116]. Moreover, unlike subjects, artefacts lack agency (see Bloor, 1999). Conversely, properties of artefacts such as functionality are not applicable to subjects. Similarly particularities exist in studying the body.

Presently, I demonstrate the manner in which subject positions can be analyzed as social-kind statuses—social institutions. I explore the presence of conventionality, self-referentiality, performativity, collectivity, and normativity in the attribution and maintenance of subjectivities. Having done so, I synthesize the various arguments into an account of subjects as artificial kinds. This final argument requires a brief consideration of the lived physicality of the individual, prefacing my discussion of bodies in Chapter Six.

5.2.1 Conventionality

Subject positions are created within and attributed by collectives of agents. As a result, subject positions display and are responsive to the many vicissitudes of differing communities. Subjectivities are conventional phenomena. The empirical data provides substantial evidence for this claim. Firstly, the data illustrates that subject positions in motorcycling are responsive to differences in engagement, in the sense that motorcyclists portray their participation within motorcycle communities as an exercise in constituting a different, alternative subjectivity to that of their everyday social interaction. Again taking the motorcycle community as a single collective, I analyze the distinct subjectivities experienced by my participants within and outside this community. Consistently, the participants noted the stark difference between their subject position as 'normal' agents and as motorcyclists. Secondly, the data displays the heterogeneity of subjectivities within the motorcycling community. Groups display internal consistency and numerous qualitative differences in relation to other motorcycling groups. Much as I note with the case of artefact ontology and speed, different communities attribute different subjectivities to their constitutive members. These differences manifest themselves both through physical transformation—clothing and other accoutrements—as well as collective practices.

[115] I will return to this discussion in Chapter Seven.
[116] To be precise, artefacts possess no capacity for knowledge whatsoever.

The participants variously reported that engaging in motorcycling represents the ability to access a different subject position, one made possible by the social practices of the collective and manifest in the act of riding. The interviews revealed that this distinct subjectivity was placed nearly always in contrast with 'normal', quotidian subject positions afforded by the various roles of family member, parent, worker, and general citizen. Participants often discussed the transformative potential of the motorcycle and the community:

> "…some can be a very serious person at the office and everything and suddenly they put chains and all of that on, they get on the cruiser, like, like the personality of the bike influences a lot." (CR-03, male, BMW GS 1200)

> "… there are people who are transformed on the bike… I know people who are very normal, they get on the bike and they transform and then they are fearless and risk their lives." (CR-20, male, BMW GS Adventure 1200)

> "There are people who have never ridden on a high-cc bike and maybe even less on a Harley and when they buy it and start to ride on it, they, it makes them change their personality. They feel tougher, they feel, or the bike makes them feel freer, and when they finally notice they're changing even the way they dress, their look and in very little time they start becoming part of the Harley-Davidson identity." (CR-24, male, Harley-Davidson Sportster 883)

The theme of transformation was pervasive throughout the interviews. The subjectivities associated with motorcycling are distinctly separated from those of 'normal' social interaction, and are available only as a function of riding. This point is particularly evident when considering the relationship between work and motorcycling. Various participants specifically noted the disconnect between their motorcycling subjectivity and that of the workplace:

> "… the ability to move without any fear through the streets, which is really hard to find in life because in businesses you have to maintain composure, you have to always be, with your suit, you have to, to maintain a stereotype. So, my love for motorcycling, dressing traditionally in black, in leather, I'm not going to do that in my normal life." (CR-21, male, Harley-Davidson Sportster 883)

> "The clothes I use to ride on my motorcycle I have back there in a closet and every day I come to the bank and I change, I put on my tie, I put on the suit and everything to play the role of director of security but really, at night when I go to the university or I go home I put on jeans, I put on the boots, the jacket, and I go on my bike." (CR-27, male, Harley-Davidson Roadking 1338)

The physical transformation is symptomatic of a transformation of subjectivity. Both participants are or have been executives with large corporations, and both occasionally lecture university-level courses; consequently, they are expected to dress with a suit and tie.

Motorcycling affords an opportunity to access a distinct subject position existent because of community practices. As such, it displays conventionality. Note also that 'normal' behaviour—'suit and tie' behaviour—becomes less 'real' once these two men begin to ride; such hierarchical structuring of subjectivities displays the differing valencies of subject positions, which do not all occupy equal relationships to the subject.

Moreover, it is possible to identify the local disparities between different motorcycling groups. The motorcycling collective—be it the BMW Motorclub or the Steel Angels—has considerable effect upon the constitution of subjectivities. Localized particularities are evident in the manners and modalities in which subject positions are attributed to and experienced by the participants in my study. Many articulated the intimate relationship between group conventions and the manner in which they experienced and understood their own subjectivity:

> "It would be naïve to say that [the group] does not greatly affect you. You enter in the patterns, the conducts, the norms, the traditions, I've seen how every time I dress more like them, I like the same things as they do. It's very clear, very, very clear." (CR-01, male, BMW GS 1200)

> "My identity is [that] of the BMW club." (CR-03, male, BMW GS 1200)

In different manners, these two participants articulate the importance of the collective in establishing personal subjectivities. CR-01 discusses the specific social practices of the group responsible for the constitution of his subject position. More directly, CR-03 states that his motorcycling subjectivity is not dissociable from the collective identity of the group. Of course, not all subjects are affected equally by the collective; mutual susceptibility is not homogeneous, and subjects conform to group standards to differing degrees. Nevertheless, even for those who have greater potential to *set* the standards, susceptibility is a requisite for group membership and subjectivity. Subject positions respond to conventionality. In distinguishing himself from one particular form of motorcyclist, a participant argued:

> "There are other ones, the cruisers, that is what they like. To transform themselves, on the weekend, change their ties and all of that and put on the helmet with the spike, the collar with spikes, the pointy boots, and possibly tattoos that come off…" (CR-34, male, KTM Adventure 990)

Unlike motorcyclists of his ilk, who ride off-road motorcycles, the riders CR-34 describes articulate their specific subjectivity through physical transformation. This convention is attributable to cruiser groups and consequently, cruiser subjectivities.

The interviews revealed substantial differences between groups, and most participants noted the entrenched distinctions that marked subject positions in the various groups I studied. These variances indicate the situated character of subjectivities, and the conventionality to which they respond.

Subject positions are *conventional*.

5.2.2 Self-referentiality

The subject positions enabled in the collectives I studied display self-referentiality in two distinct manners. First, subjectivity is self-referential in the sense that all nominative attributes are self-referential: names, labels, and categories fundamentally refer only back to themselves. As such, the nominal label 'motorcyclist' is a term that exists only in the social practice of language, and as a result is entirely self-referential (see Kusch, 1999). This form of self-reference is to be found of all words, and thus is not argument enough for my claim that subject positions are social institutions. However, subject positions are also self-referential in the sense that the attribute 'motorcyclist' does not refer unproblematically to an empirically-detectable quality; rather, it refers only back to socially-mediated practice, and participation within particular collectives. Here, I first examine the notion of a 'true biker', and discuss the manner in which this particular subjectivity is constituted independently of any alter-referent. Second, I discuss the manner in which motorcyclists refer to the motorcyclist subjectivity as an internalized quality—as something 'in the blood'. Put otherwise, subjectivity is constituted as a self-referential 'essence' located within the individual.

The motorcyclist subject position is self-referential[117]. While the technological artefact is a necessary component of this subjectivity, it is not a sufficient condition for the existence of a motorcyclist subjectivity. Ultimately, all subjectivities—including those of motorcycle communities—are products of reiterative social practices, and as such are fundamentally self-referential. Those engaged in motorcycle collectives continuously articulated a belief that the 'true' subjectivity of a motorcyclist is situated somewhere beyond ownership of a

[117] This self-referential property of subject positions serves to resolve Kripke's problem with names (1980 [1972]: 94-95), as these become facets of a collectively-endowed subjectivity.

motorcycle. That is, the participants constituted motorcyclist subjectivities as dependent upon but ultimately underdetermined by the machine itself:

> "…having a bike is one thing and being a biker is totally different, right? Having a bike does not make you a biker, it's totally different, right?" (CR-13, male, BMW GS 1150)

A precondition to possessing a motorcyclist subjectivity is ownership of a motorcycle, but the acquisition of a 'true biker' subject position requires much more than the technological artefact. The status—attributed by the community—is dependent upon social practice. Being a motorcyclist implies a commitment to the practices of the community:

> "There are people who are very purist, they say, no, a biker is someone who really uses the bike every single day." (CR-05, male, BMW RT 1200)

> "I consider myself a true biker because all of my life I've had a bike. I still have a bike. I'll die having a bike…" (CR-14, male, BMW GS Adventure 1200)

As is evidenced by these quotations, individuals must display a commitment to and passion for motorcycling that meets communal standards in order to be considered a 'true biker'. Without consistent use of their motorcycles, riders lose access to that subject position, and are branded 'garage' or 'weekend' riders—owners of motorcycles who rarely use their machines and are targets of numerous jokes and derogatory comments[118]. This is an example in the formative capability of conventional physical practices, which can define membership within a community and are themselves rendered intelligible by convention (see Collins & Kusch, 1998). Importantly, no definitive consensus exists regarding the precise number of hours or quantity of engagement that define a 'true' motorcyclist. Much as the notion of a 'true biker' itself, the requisites for achieving that subject position are somewhat opaque[119]. Nevertheless, there does exist a consistent belief that practice is paramount. Thus, subjectivities refer to other conventional phenomena, themselves existent only insofar as reiterative practices make them so.

[118] While authority can be vested with specific subjects in the collective, this form of sanctioning is fairly widespread and almost equally distributed among the members of the group.
[119] Learning to recognize who is a 'true biker' and who is not constitutes part of becoming an accepted motorcyclist.

A second aspect of self-referentiality concerns frequent references to motorcycling subjectivities as internal essences, often discussed as qualities present 'in the blood'[120]. As an internal essence, subjectivity cannot be empirically detected and is in no way alter-referential. Instead, reference to it is reference to an illusory internality, made possible within collectives of mutually-susceptible subjects. Repeatedly, participants discussed the 'true biker' as one possessing an almost fatalistic passion for motorcycling:

> "Only a person who has that, that sense for, for bikes. Like a fifth, a sixth sense, is a person who was born for it and not everybody likes bikes, not everybody… I think that it's something you have inside, inside you like the feeling for a bike." (CR-15, male, various competitive models)
>
> "Coming back to motorcycling, I think that it's a passion, right? That you carry, whatever happens, in the blood." (CR-20, male, BMW GS Adventure 1200)
>
> "But that's, that's a passion, it's a passion, motorcycling. You are born with it, you are born with it." (CR-23, female, Kymco Hipster 150)
>
> "Well it's a personal satisfaction, right? And, well, you're doing what you were born to do, because, for example, for me motorcycling has fascinated me all of my life…" (CR-36, male, various competitive models)

These participants argue that being a motorcyclist is being born a motorcyclist; furthermore, CR-20 claims that the passion for motorcycling is a property found in the blood of the rider, as do numerous other interview participants. Much like the above argument concerning the practices of a 'true biker', these references to internalized qualities indicate that the subjectivity of a motorcyclist is dependent upon but not determined by the motorcycle itself. Above, practices were required to merit the subject position. Here, that very subject position is articulated in terms of an idealized internal essence[121]. Reference to this quality is reference to an illusory internality without empirically-discernable properties, only a self-referential existence for the rider and the community within which the claim is made.

These facets of self-referentiality indicate the tenuous, reiterative character of motorcyclist subjectivities. An individual cannot gain a motorcyclist subjectivity through the technological artefact in and of itself. While the importance of material entities is unquestionable—the motorcycle, clothes, and accessories all play exceedingly important roles—their productive capability in relation to subject positions is greatly limited. Without

[120] This biological symbolism betrays the importance of the body in motorcycling—both with respect to discourse and embodied experiences. See Chapter Six.
[121] This is comparable to Kusch's notion of 'I'-statements, discussed in sub-section 5.3.1.

engaging in collective practices, the individual cannot attain the subject position of a motorcyclist. Importantly, there do not exist universal standards or requirements; each motorcycling community attributes subjectivities in differing manners.

Subject positions are *self-referential*.

5.2.3 Performativity

Again, there exists a preliminary sense in which subject positions are referents generated by collective referential practice. Subject positions, in the same manner as all social-kind statuses, are generated through the aggregate utterances of singular collective members (Barnes, 1983). The term 'motorcyclist' is a referent constituted by the ongoing referential practice of a system of agents; like any name, label, or category, its existence is made possible by its continued use. Much as with self-reference, this generic quality of performativity does little to elucidate my understanding of subject positions as social institutions; more is required. Above, I began to explore the relationship between social practices and the reiterative constitution of subject positions. Here, I document two further examples of these practices in order to demonstrate that subject positions are brought into being through performative social practices. First, I elaborate upon my earlier discussion on the primacy of practice to substantiate the performative character of subjectivities. Second, I discuss the particular case of the rebel stereotype, which is performed by numerous cruiser riders in Costa Rica through the use of specific clothing and accoutrements.

Above, I note the discrepancy between owning a motorcycle and possessing a motorcycling subjectivity. Consistently, participants differentiated between those who had purchased motorcycles and those who were legitimate motorcyclists. Statuses of authenticity are reserved for those who possess a satisfactory degree of knowledge and who use their machines on a regular basis. I argue that the practice of riding is the very act of performatively constituting motorcycling subjectivities. It is in the doing that subject positions come into existence. Says CR-10:

> "… after so many years of not riding a bike I don't consider myself a biker. I'd have to start over." (CR-10, male, Yamaha XT 375)

CR-10 had been an active and enthusiastic motorcyclist in Guatemala during the 1980s. When he was asked to move to Costa Rica for work-related reasons, he sold the motorcycle.

Since then, he has not ridden or owned a motorcycle, although he is very interested in re-engaging with motorcycling. His quotation illustrates that his lapse in practice invalidated his subject position as a motorcyclist. He also indicated that gaining such a subjectivity is a process, and not an immediate occurrence. Comparably, CR-13 stated:

> "The cyclist has his new car at home and goes on bicycle to work every day. And during the weekend you see him in San Carlos on his bicycle or you see him in Puntarenas. That's a cyclist… It's the same. The motorcyclist can't live without riding his bike every single day." (CR-13, male, BMW GS 1150)

In comparing a cyclist to a motorcyclist, CR-13 is illustrating the primacy of practice. 'True' motorcyclists—as I began to discuss in sub-section 5.2.2—are those who are constantly using their machines. This quotation illustrates the need for reiterative practice. Motorcyclists must consistently *perform* their subjectivity by engaging in conventional practices. It is not simply singular acts of riding that actively constitute subject positions, but rather continuous and collectively-mediated practice[122].

A second example of performativity concerns the image of the rebel biker, and the manner in which numerous motorcyclists electively engage with the stereotype through physical displays. There exists a significant disparity between the traditional, stereotyped behaviour of United States motorcycle gangs—such as the Hell's Angels—and the practices of cruiser groups in Costa Rica—such as the Steel Angels. However, members of the latter actively engage with the stereotype and image of the rebel motorcyclist as part of their conventional practices. Their choice in doing so demonstrates the performative character of subjectivity. Using clothing and other accoutrements, the members of Steel Angels—as well as other groups including the Harley Owner's Group and the Black Widows—perform a dangerous, tough, and aggressive subjectivity in stark contrast with their 'everyday' subjectivities[123]. First, it is necessary to reinforce the importance of clothing in relation to motorcycling groups. Says CR-01:

[122] There exists an interesting contradiction with regard to acts of riding. Displaying proficiency and engagement is an important element in creating and sustaining a motorcycling subjectivity. Nevertheless, doing so simply for the sake of 'showing-off' is seen in a negative light. As such, motorcyclists must display their use of the motorcycle while remaining aware not to do so simply for the display.

[123] Another reading of this is that different communities perform different masculinities and femininities. See Schyfter, 2008 for a study on collective-bound masculinities in sport.

> "Every group dresses differently and it's very distinct… there's lots of homogeneity within each group. You have the leather, right, the Harley ones, with the tattoos, with bandanas, with skulls, with that type of thing." (CR-01, male, BMW GS 1200)

The symbolic function of clothing is particularly important to cruiser bikers[124]. The leather, tattoos, bandanas, chains, and studded wristbands serve to perform a particular set of subject positions associated with rebel motorcycle gangs such as the Hell's Angels as well as with cultural stereotypes of cruiser motorcyclists evident in such films as *The Wild One* or *Easy Rider*. Says CR-21:

> "The general concept is that we're bad. Yeah. Because of some stereotype… it comes from the gangs and a group that was formed in the United States which was called Hell's Angels. So, yeah, we scare people. When you see a group of cruisers park, they get off, tattooed, covered in leather, they say, 'well these guys are going to burn the town'." (CR-21, male, Harley-Davidson Sportster 883)

The subject position of criminal outlaw motorcyclist is one actively sought by numerous motorcyclists in Costa Rica. Unlike the United States, Costa Rica lacks a history of criminal motorcycle gangs, but the stereotype is embraced and performed by cruiser motorcyclists in part to define themselves. Clothing and accessories perform these subjectivities, which are often in contrast with the riders' 'everyday' subjectivities:

> "… motorcyclists are recognizable by their physical presentation. Those groups that have tattoos and all of that look like wild people but many times they're not, although they look like it." (CR-10, male, Yamaha XT 375)

> "… there are some that, let's say, they work to look like renegades. To look tough. Maybe they are not, but their way of being, they want to act like being very tough, very bad, and I think that it's a motorcycling stereotype." (CR-12, female, BMW C 1200)

> "… the majority of our groups, although many of them have that philosophy of dressing like [the Hell's Angels], they are not like them. The great majority of our clubs in Costa Rica are clubs of normal people who some like to dress up on weekends as rebel bikers and during the week are normal people." (CR-33, male, Suzuki GSX FE 1400)

> "… at the end you feel a bit like a rebel. Let's say, in the case of us, the Steel Angels, we all behave a bit like rebels but when it comes to the way we drive, on the road, we stay within the boundaries of the law, we try not to go over the speed limits, to not run red lights…" (CR-24, male, Harley-Davidson Sportster 883)

[124] For a report on motorcyclist clothing and its symbolic importance in wider society, see Trebay, 2008.

The various quotations evidence the ubiquity of this form of material and visual performance, which brings into being a subject position associated with rebel outlaws[125]. Cruiser bikers are reputed as constantly engaging with this stereotype despite their lack of criminal behaviour[126]. The subjectivity is a function of clothing and cultural association.

These two examples—the primacy of practice and the articulation of rebel subjectivities—evidence the importance of *doing* in the construction of subject positions. In carrying out social practices, motorcyclists are constituting, reinforcing, and sustaining their particular subject positions. The participants note that without such practices—be they consistent and frequent riding or particular uses of clothing and accessories—their subjectivities as motorcyclists are not possible. Through practice, these are brought into being.

Subject positions are *performative*.

5.2.4 Collectivity

Above, I argue for the conventional character of subject positions. A fundamental component of conventionality is collectivity; all social institutions—in this case subject positions—are collectively-constituted. Any social account of subjectivity ultimately rests upon this proposition: that it is within social groups that subject positions exist. While the collectively-constituted character of subject positions has been implicitly discussed in the above sections, I here proffer empirical substantiation for this claim. First, I discuss the importance of collective practice for motorcycling, as well as the various ways in which interpersonal relationships inform the constitution of motorcycling subjectivities—much as they do for the ontology of the machine. Second, I discuss the influence of the collective upon the practice of driving; collective standards, patterns, and expectations influence the act of driving the motorcycle. Practice is of fundamental importance to the constitution of subjectivities, and individual practice is collectively-constituted.

Motorcycling is a collective endeavour. Consistently, interview participants described the importance of social interaction in motorcycling. Those who ride outside of organized groups are rare, and generally those who choose not to participate in motorcycling

[125] This data also betrays the entanglement of artefact and subject ontologies, as the machines themselves are associated with a particular type of rider. See Chapter Seven.
[126] These groups often counter the visual display of criminality with charitable acts such as rallies to raise money for community needs, one of which I attended during my time in Costa Rica.

communities still undertake trips with a close group of friends. While riding with others serves a logistical end—in the event of an accident or a mechanical failure, it helps to have other motorcyclists nearby—my participants described riding in numbers in other terms as well. Those participants that chose to ride with organized groups noted the importance of group affiliation and collective experience:

> "You always look in motorcycling, except for those lone wolves that run around, who are few, you look for a group of identification. Harley is H.O.G., all the same and dressed the same, and you can be a medic and the other one can be a shoe-maker and it does not matter and we all identify the same way. The BMW group is no different… You look for a group of identification." (CR-05, male, BMW RT 1200)

> "… I think that the issue is about situating yourself. Motorcycling, just like recreational automobility or cycling, right, I think that the idea is sharing in a group. Not living in an isolated form because in a world like the one we have you can't be isolated in society. You have to interact with people, you can't lock yourself in…" (CR-27, male, Harley-Davidson Roadking 1338)

These participants discuss the importance of communal interaction in the process of 'identification' and 'situating' oneself. CR-05 notes explicitly that within the collective social differentiators—such as work and class—are replaced by a common motorcycling subjectivity[127]. Moreover, he argues that motorcycling as a sport metaphorically 'looks for' collectivity, as if the sport itself has a communitarian imperative. CR-27 similarly argues that motorcycling is about 'situating' the individual within a set of communal practices. Within these collectives, individuals gradually conform to the shared practices of the group:

> "… on your way of being, it's natural. He bought a jacket. 'Oh, that's a nice jacket, where did you buy it? 'Oh, at so-and-such a place.' He gave me the info, boom, I ordered it." (CR-17, male, BMW GS 1200)

Of course, the influence of communal agreement extends beyond the material. The community influences individual practice (Barnes, 2001b), knowledge (Kusch, 2002), and experience (Kusch, 1997 and 1999). Nevertheless, fashion is often an arena of group influence[128], and methodologically is a useful proxy for gauging collective conformity and communally-homogeneous subject positions.

Above, I note the central role played by practice in performing subject positions. I can elaborate upon this claim by demonstrating the collective influence upon practice, and

[127] Note the contradiction with regard to my earlier discussion of 'elitist' and 'classist' motorcycles.
[128] C.f. Simmel, 1957.

consequently upon the constitution of subjectivities. The reticulation of practice, community, and subjectivity is critically important in studying subject positions as social-kind statuses:

> "[The group] affects the way a person is. The person who drives a motorcycle is the way in which he drives the motorcycle." (CR-22, male, Honda Goldwing 1832)

This quotation succinctly captures two principal claims. First, practice is fundamentally involved in the constitution of the subject position—a claim I previously make. Second, practice is affected by the community within which it takes place. Not only does the community define the parameters of intelligible physical practice (Barnes, 2001b; Collins & Kusch, 1998), but sanctioning, mutual-susceptibility, and self-correction also result in the collective origin of individual practice (Rafanell, 2002). Within motorcycling communities, this collectivity is ubiquitous:

> "Of course [the group] has influence. Because if I go with, I think it's natural, it has influence on the way of driving. If the guy ahead goes very fast you try to reach him a little bit…" (CR-17, male, BMW GS 1200)

> "Let's say, the group I rode with, there existed rules for riding. Let's say, if I left third, let's say to ride, to ride with the group they always asked us to ride in [Z formation][129]." (CR-23, female, Kymco Hipster 150)

Groups can be characterized by—among other facets of practice—different riding formations, different driving patterns, and different standards of acceptable behaviour. All of these practices influence the constitution of subjectivities. Succinctly stated, collectives define practice and through practice, subjectivity. As such, subject positions are collectively-constituted.

The subject positions I analyze here are more than simply situated within collectives: they are enabled by them. It is in social interaction, in the heterogeneous practices of communities, that subjectivities are constituted.

Subject positions are *collectively-constituted*.

[129] In 'Z formation', every other motorcycle is offset from the one in front of it. From above, the formation would look like a 'zig-zag' pattern. The formation allows the group to minimize accidents during a sudden stop.

5.2.5 Normativity

Finally, I must address the issue of normativity and subject positions. Again, I must account for the general sense in which subjectivities are susceptible to normativity. As I note in Chapter Three and discuss in further detail in Chapter Four, normativity is a central and required component of concept application. Without collective sanctioning of incorrect usage, no concept could be stable. The term 'motorcyclist' can be applied 'correctly' or 'incorrectly' and the person applying the term is susceptible to sanctioning should the usage of this term contradict the accepted standard. My reference to a BMW motorcycle driver as a 'Harley motorcyclist' or a 'chopper motorcyclist' would be incorrect. In either of these circumstances, my deployment of the status terms would be met with sanctioning. More relevant to my immediate concerns is the notion that subject positions are open to normative judgement from the community within which they are lodged. This sub-section demonstrates the normative character of subjectivities by addressing two empirical themes. First, I discuss the negotiation of membership within a motorcycling group. This component of my argument addresses the sanctioning of members who fail to adapt to group standards. I use the particular case of ACOMORE—one of Costa Rica's largest and certainly it's most organized motorcycling group—to demonstrate the manner in which potential members of a group are evaluated before their entrance into the organization. Second, I consider the relationship between rules and subject positions. Often group membership—and thus subjectivity—is challenged by a failure to follow rules, and by collective sanctioning of this disregard for convention. Following rules is a practice often praised by members of the collective; as such, rule-following is an important aspect of a group's idealized subjectivity.

Within most groups, subjects display a significant degree of homogeneity. My empirical observations indicate that a central characteristic of group membership[130]—a specific subject position—is the agent's capacity to conform to group standards. The patterns, conducts, norms, and traditions that I note in relation to the conventionality and collectivity of subject positions are also imperatives, policed and sanctioned by the community. Following Barnes' interpretation of Weberian 'status groups' (1992 and 1995), motorcycle collectives employ

[130] It might appear exceptionally convenient to study group membership in advocating the collective origin of subject positions. My analysis of collectives was a methodological choice predicated on a series of reasons outlined in Chapter Two. My work on subjects as collective accomplishments extends to all groups of agents, including those not formally organized. Remember: subjects exist in social interaction. Thus, no subjects exist outside of at least one group.

various inclusionary and exclusionary practices to define the character of the community and safeguard its integrity. Thus subjects negotiate their subjectivities in normative terms:

> "I think that at the end you have to be influenced, and if you don't let yourself be influenced then you end up outside the group." (CR-05, male, BMW RT 1200)

> "… the moment that you no longer like the group because people started to join who are very different from what you thought, then simply what you do is that you leave…" (CR-19, female, Honda Shadow 600)

> "… every group has its identity and every member that arrives and doesn't identify, he repels himself, he starts leaving the organisation." (CR-21, male, Harley-Davidson Sportster 883)

Subject positions are open to normative adjudication and sanctioning by all members of the collective. Riding too fast or acting in an inappropriate manner can be sanctioned, and without self-correction, the motorcyclist is liable to lose the subject position defined by membership within that group. One conspicuous example of this phenomenon is that of ACOMORE. This organization is one of Costa Rica's largest motorcycling groups. It is also reputed as the most organized group and the one with the strictest entry protocols. While all groups demand some form of entry requirement—be it related to the machine itself, or to age, or to the size of the group—ACOMORE is notorious for its challenging application process. The group's president describes the procedure as follows:

> "[The applicant] has to go out, participate with us on three trips, three activities. During those three activities or trips we see how the candidate works, we evaluate him, the candidate sees how we are, he sees what our philosophy is like, what our identity is. If he agrees, he fills out an application form where we ask for his details… he also has to be recommended by two active members, who are his sponsors and if everything, if they meet with everything and we likewise evaluate the person, his life… that he's an honourable, responsible person, that he meets the standards set by the leadership… and of course moral standards that guide us in our lives and if he meets everything, well the leadership is in charge or approving or rejecting him." (CR-33, male Suzuki GSX FE 1400)

The normative expectations for potential and current members of the group are significant and strictly enforced. Without meeting the group's norms, initiates will not be granted membership, and current members face expulsion should they similarly fail in conforming to the collective expectations of ACOMORE. While this group represents an extreme among Costa Rican motorcycling organizations—rarely do other groups explicitly care about a person's moral standards or their behaviour outside group activities—normative requirements are a component of all organized motorcycling collectives. This example very

clearly demonstrates the normative character of subjectivities. It also illustrates the role of authority and the inherent power differentials within communities; the group leadership has more authority than the membership, which has more authority than the neophyte. Susceptibility to others is inversely proportional to this ordering.

A related phenomenon is rule-following. Even the most lax organizations are characterized by collective conventions and rules. Should a member violate these—say by drinking alcohol during a trip with the BMW Motorclub or disregarding the standard riding formation with the Black Widows—that member would be reprimanded. The manner in which subjects behave, in which they ride their motorcycles and engage with their subject positions, is open to the scrutiny of other community members. While these rules may represent arguably superficial requirements, such as flying the required yellow pennant with the Coyotes, they may also constitute more substantial imperatives, such as following the standard 'Z' formation to ensure safety with the BMW Motorclub. Patterns, conducts, norms, and traditions are centrally involved in the constitution of subjectivities; failure to meet these standards has appreciable results for any member's subject position[131]:

> "Every group has its rules for the road because we're like ants, right? We have rules and you go in a line if it's in the mountain and if it's open field then you go two by two. Nobody passes each other. Every one has, every group has its rules. If in the group the rules aren't respected then the president of that group tells you that you can't continue with that group…" (CR-16, female, Suzuki Intruder 800)

> "… we [ACOMORE] have expelled two people because they have infringed on our code of practice, our rules…" (CR-33, male, Suzuki GSX FE 1400)

Subject positions are defined by collectives. Collectives can be defined similarly by their rules and regulations. Thus subject positions are functions of collectively-constituted rules[132]. This statement is fundamentally identical to my earlier discussion of the conventional character of subjectivities, as rules are entirely conventional (Bloor, 1997b). Not only are subject positions normative in the sense that subjects must follow standard practices to retain their subjectivity, but they are normative insofar as to follow a rule is to hold a subject position. Numerous participants articulated this point in describing the traits of 'good' motorcyclists. Normatively 'good' motorcyclists were those who follow group standards and rules:

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[131] C.f. Scheff's work on shame and intersubjectivity (2000).

[132] "To interpret the behaviour of a contemporary as typical means to explain it as the behaviour of 'a man like that one' or 'one of them.'" (Schutz, 1972 [1932]: 193-194)

> "… there are motorcyclists in the group who show a lot of solidarity with the group, in things as simple like when you are driving, that they point out [dangers on the road] or that they follow the rules that you've established for the group…" (CR-01, male, BMW GS 1200)
>
> "I respect them when they obey the rules. When they embrace the rules." (CR-05, male, BMW RT 1200)

Rules thus define subject positions in a variety of manners. First, they are requisites in order to obtain subject positions. Second, the collectives that enable subjectivities are founded upon shared conventions and rules. Third, the practice of rule-following is analytically indistinct from the practice of occupying a subject position. Finally, rule-following is a facet of numerous participants' definitions of a normatively 'good' motorcyclist[133].

Subject positions are *normative*.

5.2.6 Subjects are A-kinds

I have demonstrated that subject positions (subjectivities) are conventional, self-referential, performative, collectively-constituted, and normative; they are social institutions[134]. Subject positions are as such analytically comparable to artefact ontologies; consequently, subjects are likewise analytically comparable to technological artefacts. Simply stated, subjects are artificial kinds. As I note previously, this implies that subjects have a definite and alter-referential materiality, as well as an entirely self-referential ontology.

Subjects posses a physicality that exists independently of social practice, and specifically, exists independently of any subject position[135]. Above, I referred to the empirically-identifiable living entity as the *individual*; these physical beings constitute the material

[133] Other ways in which the participants discussed 'good' motorcyclists include: skill, loyalty, respect for others, safety, passion, physical condition, technical know-how, care for the machine, and self-control.
[134] "A status, a position, a social place is not a material thing, to be possessed and then displayed; it is a pattern of appropriate conduct, coherent, embellished, and well articulated. Performed with ease or clumsiness, awareness or not, guile or good faith, it is none the less something that must be realized." (Goffman, 1990 [1959]: 75)
[135] Importantly, this physicality is *not* the subject's body, which is a social product, as I discuss in Chapter Six.

substrate upon which collectives attribute subjectivities[136]. Subjects are individuals with statuses, responsibilities, and privileges. Subjects are individuals embedded within social interaction. The existence of this physical substrate is (again) a fundamental component of our 'everyday' practices. The physical experiences of an engine's vibrations, of banking around a corner, of wind racing past the motorcycle all presuppose the existence of the individual. This discussion receives comprehensive treatment in Chapter Six, which is dedicated to issues of materiality and corporeality. For now, it is sufficient to note the commonsensical experience of physicality associated with all subjects.

A second argument in favour of the existence of all subjects' materiality derives in a similar fashion to my earlier discussion of statuses and spatio-temporal entities. I will not rehearse this argument here, but summarize it as follows: all statuses are attributed *to something*, and this 'something' necessarily possesses a spatio-temporal existence. If subjectivities are statuses, then they require a physical substrate: the individual.

Similarly, all individuals require a subject position in order to exist as socially-engaged agents. The conventional and normative expectations, responsibilities, and privileges to which all subjects are responsive are attributes of a subject position. As I established above, a series of social requirements must be met in order for the subject 'motorcyclist' to come into existence by being granted the subject position of 'being-a-motorcyclist'. Like all subjects, a motorcyclist is so because of a subjectivity attributed to the individual (the property of being-a-subject). The subject's very intelligibility as a member of a community is dependent upon a subjectivity. The individual—the purely physical—underdetermines the subject.

This section contains a series of crucial arguments. First, subject positions are social-kind statuses (social institutions). Second, the physicality of the subject is real and is demonstrable by numerous arguments. However, this physicality is not enough to justify the attributes of subjects, such as responsibilities, privileges, and social intelligibility. All subjects have an independent materiality, but one which underdetermines the subject's status within social life.

Subjects are *artificial kinds*.

[136] This is not to suggest that subjects positions are merely social paint applied to a pre-existent subject. The physical substrate has no ontology as a socially-situated subject (c.f. Butler, 1989 on bodies).

5.3 The 'I': Collectives and self-knowledge

The previous section outlines my conceptualization of subjects as artificial kinds. As I note earlier in this chapter, subjects display particular difficulties for communitarian analyses. So far this analysis of subjects has taken an almost identical shape to my earlier account of technological artefacts; to wit, I have analyzed both subjects and artefacts as artificial kinds, and subjects positions and artefact ontologies as social-kind statuses. In this, little distinction can be made between the two analyses.

Fundamental differences exist, however, in examining the constitution of subjects. These differences can be subsumed within the general category of self-knowledge. Artefacts have no capacity for self-knowledge[137], while subjects inevitably do. This difference is manifest in a number of different problems for the communitarian sociologist of subjectivity—four of which I describe here and to which I respond below.

First, there is the problem of privileged first-person knowledge. Subjects have experiences, feelings, thoughts, memories, and visceral reactions inaccessible to other subjects and arguably unrelated to interpersonal practice. Most fundamentally, how can a communitarian epistemology account for any subject's conception of the self? This most rudimentary component of self-knowledge arguably falls into the category of individualistic phenomena. Moreover, a communitarian epistemology is at pains to demonstrate the social origins of emotion, the affective component of which strongly suggests an individualistic conceptualization.

Second, there exists the general problem of agency. Unlike subjects, technological artefacts are not endowed with agency (see Chapter Seven in this volume; Barnes, 2000 and 2001a; Bloor, 1999). Consequently, technological artefacts have a fundamentally different relationship to collective practices—here critically that of classification—from that of subjects (Hacking, 1999). Agency must be described and conceptualized as a collective good. Moreover, this study must note what, if any, effects agency has upon the constitution, articulation, and possible contestation of subject positions—a problem not encountered with artefact ontologies.

[137] Indeed, they have no capacity for knowledge at all. See Kusch, 2002 for an argument on the communitarian basis of knowledge and Hutchins, 1995 for a study on cognition, knowledge, and technological artefacts.

Third—and following from the general problem of agency—a communitarian epistemology of subjectivity must conceptualize the various iterations of performativity in relation to subjects. Hitherto, performativity has referred to the manner in which collective practice brings into being a new state of affairs, such as an artefact's ontology or a particular subject position. However, performativity can also refer to the manner in which individual action, situated within the appropriate social context, can accomplish comparable ends. Put otherwise: single subjects are capable of performance in a manner not available to technological artefacts[138].

Fourth, I must address the problem of interaction. Subjects possess agency and are capable of performance. These two facets of subjectivity imply that subjects can interfere with and react to the very practices of classification responsible for the existence of the subject. That is, subjects can actively react to the manner in which their subjectivities are formulated and taken up. This problem is particularly tenacious, as it leads to a range of difficulties in conceptualizing the subject-collective relationship, and has significant ramifications for my analysis of subjectivity.

If I am to pursue a communitarian understanding of subjects, then I must account for these ostensibly individualistic phenomena. I first proffer an answer from the Strong Programme. Next, I address arguments from Foucault, Butler, and Hacking, which complement my use of PTSI and contribute unique solutions to these problems.

5.3.1 Kusch and 'I'-statements[139]

Martin Kusch's usage of PTSI in examining privileged first-person access and the phenomenon of the 'I' is relevant to the problem of self-knowledge. Kusch, in his various studies of folk psychology as a social institution, addresses the logic and character of the 'I' in a fashion founded upon and that extends the applicability of the Performative Theory of Social Institutions. Resisting Anscombe's injunction that 'I' fails to operate in a referential manner (Anscombe, 1975), Kusch proposes a sociological solution to the logic of 'I' by studying 'I'-statements—speech acts in which the agent employs 'I' to self-ascribe states and events.

[138] For more on the requirements of performativity, see Austin, 1965 and Rafanell, 2008.
[139] This section draws its content from Kusch, 1997 and 1999 unless otherwise noted.

Kusch argues that 'I' is a social institution. Specifically, he discusses the possibility that the use of 'I' is a self-referential phenomenon, constituted by two components: the so-called *collective* and *individual* components[140]. The former refers to the conventional practices by which agents employ the word 'I' in relation to themselves. Otherwise put, the *collective* component encompasses the character of 'I' as a social institution in the same manner as all words are social institutions. The *individual* component refers to 'I' in practice within speech acts, and the manner in which this word is employed by the speaker to ascribe states and events unto him/herself. Moreover, the *individual* component focuses upon the role of the predicate in 'I'-statements in ascribing qualities unto the speaker, and the collective's function as an adjudicative body in validating or sanctioning these attributions.

The *collective* form of self-referentiality is constituted by the meaning and use of 'I' as a term of reference. 'I' is self-referential in the same way as all social institutions are self-referential. The term 'I' has meaning, and this meaning is given by the collective within which it is being used:

> The meaning of 'I', its correct and incorrect uses, rests with the collective, and it is continuously negotiated by its members. The meaning of 'I' is what we collectively take to be this meaning. (Kusch, 1997: 20)

The conventional and collectively-constituted meaning of 'I' has no foundation outside of collective practice. As a term with meaning and normativity, 'I' is a self-referential phenomenon.

The *individual* self-referentiality of 'I' is more intricate. This second facet of 'I' pertains to the performative nature of 'I'-statements, and the manner in which agents employ these statements to self-ascribe states and events. Succinctly, reiterative acts of self-ascription through 'I'-statements—mandated by the community—refer back to previous 'I'-statements, and not an existent interiority.

[140] Kusch's choice of terms to designate these two components is somewhat unfortunate. By counterpoising 'collective' and 'individual' components, Kusch implies a fundamental separation between the two, and might even be interpreted as stating that a unique, entirely individualistic element of 'I' exists. I use his terms for consistency here, but more precise terms might be: nominative (collective) and attributive (individual).

Firstly, it is possible to study the collective imperative of a subject's repeated use of 'I'-statements. Kusch argues that the subject's use of 'I' is fundamentally guided by the collective meaning of the term. At the heart of this meaning is the imperative that:

> 'I' can (and must) be used by a member of the collectivity to ascribe states and events to herself or himself. (Kusch, 1997: 21)

We are compelled to use 'I' in everyday interaction in order to identify and ascribe qualities to ourselves as individual members of the community, as well as to acknowledge others' usage of 'I'-statements to ascribe states and events to themselves.

Secondly, each instance of self-ascription—each 'I'-statement—refers back to previous instantiations of self-ascription. That is, the 'I' in 'I'-statements self-refers to the 'I' in earlier 'I'-statements. Our usage of 'I' to refer to our self is an act of referring back to earlier usages, not an act of referring to an existent interior entity or being.

Taken together, the *collective* and *individual* components illustrate the self-referential nature of 'I', as well as the performative character of 'I'-statements. Because of this self-referential, self-validating nature of 'I', a temptation exists within Kusch's analysis to regard all 'I'-statements uttered by the self-ascriber as true and—importantly—*self-validating*. This attractive, though ultimately flawed, conclusion incorrectly attributes to the entire 'I'-statement the properties reserved strictly for the statement's logical subject: the 'I'.

In any given 'I'-statement, the very use of 'I' is self-validating, given my analysis above; however, the logical predicate does not operate in an identical manner. That is, "[w]hat I ascribe to myself is not self-validating." (Kusch, 1997: 21) Arguing otherwise would amount to subscribing to a belief in radical self-creation, unbounded and perfectly performative (c.f. Austin, 1962).

Instead, the predicative component of 'I'-statements is bounded by and intelligible only within particular collectives[141]. The usage of 'I' is similarly dependent on social interaction, but once the collective meaning is established, the usage of the term 'I' is self-validating. The entirety of any individual 'I'-statement, however, is susceptible to further checks:

[141] And in particular, in concordance with specific social orders.

> Not only does individual 'I'-talk depend on the social institution of 'I'-talk, but what individuals can rightfully ascribe to themselves is also restricted by the communities in which they live. (Kusch, 1997: 23)

Should I state, 'I am a BMW motorcyclist', my usage of 'I' is self-referential and self-validating, but the predicate 'am a BMW motorcyclist'—what I am attempting to ascribe to myself—is not: I am no kind of motorcyclist. This particular predicate depends upon the conventions, norms, and accepted knowledge of a specific collective for its validity[142]. Thus the entire 'I'-statement is not self-validating; self-knowledge is inextricably situated within collective practice. Below, I discuss the normative facet of self-ascription and self-knowledge in relation to age-appropriate practices in motorcycling.

Kusch helps establish a series of critical arguments. The 'I' is a self-referential term in that it displays the characteristics of a social institution. Repeated 'I'-statements are required by the collective and perform the interiority to which they refer, and are as such self-referential and collectively-constituted. Finally, self-ascription and self-knowledge are curtailed by community standards, traditions, patterns, and practices; as such, self-ascription is not unbounded, and is a conventional phenomenon.

5.3.2 Foucault, Butler and subjectivation

Michel Foucault's and Judith Butler's works on the many problems of subjectivity contribute to this present discussion variously. Specifically, both authors' work on the relationship between constitutive power and the subject elaborates my understanding of the collective character of subjectivities. Additionally, Foucault's work on 'practices of the self' is an important component of this enquiry insofar as he discusses the connections between collective norms, self-understanding, and the practices of subjectivation by which an individual becomes a subject. Finally, Butler's discussion of agency directly addresses the relationship between individual agency and the collective.

Both Foucault and Butler argue that power is productive of subjects. Power—a collective good—is articulated via discursive formations and determines the intelligibility of subject positions (Butler, 1997; Foucault, 1991 [1975] and 1998 [1976]). Only within specific discursive formations can and do subjects come into existence:

[142] There exists an interesting relationship here between Kusch's self-ascription and Kripke's descriptors (1980 [1972]). The two can be considered congruent problems.

> … whenever Foucault spoke of the subject he referred principally to the subject as 'subjected'—as the product of dominating mechanisms of disciplinary power. (Sawicki, 1996: 161)

Outside collectives, individuals lack subject positions. Consequently, subjectivities are dependent upon communities and collective knowledge and practice. Foucault and Butler argue that this dependence takes the form of a subjection to disciplinary power, but their fundamental insight concerns the necessity of (multiple) social frameworks within which subjects are made intelligible.

Butler expands upon this question in her study of subjects, agency, and self-knowledge (1997). As I argue above, it is necessary to account for subjects' agency in a manner that does not violate my communitarian analysis of subjectivity. Butler argues that the selfsame disciplinary power responsible for the constitution of the subject also enables that subject's agency:

> Subjection consists precisely in this fundamental dependency on a discourse we never chose but that, paradoxically, initiates and sustains our agency. (Butler, 1997: 2)

The reiterative acts of subject formation constitute and sustain agency. These acts are themselves guided by disciplinary power—a collective (though unevenly distributed) good. As such, agency is a phenomenon produced and validated by the collective[143]. Importantly, Butler argues that while agency is enabled by power, it is by no means constrained by it:

> …what is enacted by the subject is enabled but not finally constrained by the prior working of power. Agency exceeds the power by which it is enabled. (Butler, 1997: 15)

While subjects have the capacity to act in a manner not limited or determined by the discursive formation, their agency is nevertheless initially enabled within a specific system of rules. Agency is a phenomenon produced within collectives but ultimately underdetermined by them. This understanding of agency is remarkably similar to and analytically congruent with Barnes' rendering of the concept (2001a), which posits 'free action' as action capable of being understood within existing social institutions: it is a

[143] C. Wright Mills' notion of "vocabularies of motive" (1940) further contributes to this analysis by notion that motives for action are defined and sustained by collective practice.

collective good. Below, I document this phenomenon in relation to intelligible practices of age and technology.

Finally, it is necessary to address the question of self-knowledge and the formation of the subject. Foucault's work on subjects and power consistently recognizes the influence of disciplinary power on a subject's self-understanding, as well as on that subject's self-regulation. Power constitutes both the collective's understanding of the subject as well as the subject's 'internal' knowledge:

> This form of power applies itself to immediate everyday life which categorizes the individual, marks him by his own individuality, attaches him to his own identity, imposes a law of truth on him which he must recognize and which others have to recognize in him. It is a form of power which makes individuals subjects. There are two meanings of the word 'subject': subject to someone else by control and dependence; *and tied to his own identity by a conscience or self-knowledge*. Both meanings suggest a form of power which subjugates and makes subject to. (Foucault, 1982: 781, my emphasis)

A subject's 'conscience'—self-knowledge—is a product of the disciplinary power exerted by the collective and responsible for the existence of the subject. Foucault expands upon this claim in discussing 'practices of the self'—actions undertaken by the subject as part of a process of conforming to collective standards:

> There is no specific moral action that does not refer to a unified moral conduct; no moral conduct that does not call for the forming of oneself as an ethical subject; and no forming of the ethical subject without 'modes of subjectivation' and an 'ascetics' or 'practices of the self' that support them. (Foucault, 1990 [1984]: 28)

Unified moral conducts—collectively-constituted norms—inform the constitution of the subject within any community. The constitution of the subject likewise requires a particular set of practices carried out by the subject upon the self. That is, a subject's self-understanding and the practices demanded by that self-knowledge are functions of collectively-constituted disciplinary power. This is a different perspective on Kusch's discussion of self-ascription and self-knowledge, and allows the analyst to recognize issues of power. While Kusch elides power in his discussion of self-knowledge, Foucault complicates collectives by noting power differentials. Not all agents are equally susceptible, and not all agents have equal influence over each other's self-understanding and self-regulation.

Foucault and Butler's work on subjectivation provides this study with a series of useful ways to theorize subjectivity. Subjects are products of power, insofar as collectively-constituted discursive formations serve as the foundation upon which subjects become intelligible. Next, agency is similarly a collective good, produced and sustained by collective disciplinary power but ultimately more expansive. Furthermore, self-knowledge is a fundamental component of the creation of the subject, and is a product of collective imperatives. Finally, practices of the self—a subject's self-understanding and self-regulation—are functions of disciplinary power in the same manner as subjectivity.

5.3.3 Hacking and dynamic nominalism

Ian Hacking's studies on kinds and the productive relationship between subjects and knowledge about subjects contribute valuably to this study. First, his work on the singular character of so-called 'human kinds'[144] as products of communal convention and local contingency resonates clearly with my conceptualization of subjectivities as social institutions, likewise dependent upon convention. Second, Hacking's argument that human kinds have an intrinsic 'interactive' (1999b) component characterized by 'looping effects' (1995) addresses the notion that subjects are capable of responsive self-knowledge. Finally, his claim to 'dynamic nominalism' (1999a) provides the tools with which to consider the relationship between collectives, kinds, and agency.

In attempting to differentiate between natural and human kinds, Hacking first notes that human kinds are often dependent upon social practices and contexts[145]. That is, if certain social criteria are not met, then human kinds are no longer intelligible:

> The chief difference between natural and human kinds is that the human kinds often make sense only within a certain social context. (Hacking, 1995: 362)
>
> As with almost every way in which it is possible to be a person, it is possible to be a *garçon de café* only at a certain time, in a certain place, in a certain social setting. (Hacking 1999a: 167)

Hacking clearly notes the social contingency of human kinds. The *garçon de café* is a subject intelligible only given a series of social preconditions, and only insofar as others'

[144] While Hacking eventually replaced the term 'human kinds' (1995) with 'interactive kinds' (1999b), I retain his original label, as it makes evident my concern with subjects.
[145] Hacking's differentiation between natural and human kinds changes throughout the various works in which he discusses the topic. For a critique of his approach see Cooper, 2004.

interactions with him are consistent with that subject position. His argument mirrors my claim regarding ontology; while natural kinds are ontologically indifferent to social practice, subjects are characterized by their dependence upon it. There exists a fundamental relationship between collective social practice and subjectivity.

Hacking's primary concern in studying human kinds is that of 'dynamic nominalism' (1999b). I note above that subjects present the unique difficulty of actively reacting to their categorization as subjects. Comparably, Hacking notes that—in contrast with natural kinds, which are applied to 'indifferent' (1999b) entities[146]—human kinds are applied to entities capable of altering their behaviour in response to any categorization:

> If H is a human kind and A is a person, then calling A H may make us treat A differently… We may reward or jail, instruct or abduct. But it also makes a difference to A to know that A is an H, precisely because there is so often a moral connotation to a human kind. (Hacking, 1995: 368)[147]

Dynamic nominalism captures the notion that referential practice involving human kinds is necessarily elastic and inevitably changing. Subjects react to their categorization and modify their behaviour—possibly to conform to or alter the kind[148]. As such, the kind itself changes. This phenomenon, which Hacking refers to as 'looping effects' (1995), is ubiquitous in studies of human behaviour within such fields as psychiatry and criminology. I argue that dynamic nominalism is a far more commonplace phenomenon, affecting subject's self-understanding:

> The awareness may be personal, but more commonly is an awareness shared and developed within a group of people, embedded in practices and institutions to which they are assigned in virtue of the way in which they are classified. (Hacking, 1999b: 104)

Self-knowledge is linked with collective practice. While aspects of this awareness are indeed privileged—and thus out of the reach of other subjects and the gaze of the social researcher—the constitution of this self-awareness nevertheless is conventional. Below, I discuss the relationship between classification and subjects' practices in noting differences between motorcyclists who conform to their age classification and ones who challenge it.

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[146] While Hacking's use of 'natural kinds' is similar to the Strong Programme's use of the term, the two are not identical. My use of 'natural kinds' is in concert with the latter, not Hacking.

[147] This might be compatible with Heidegger's notion of Dasein (2005 [1927]).

[148] "'If *A*, *B,* and *C* are playing poker, then their behaviour is oriented to a certain action model *M*.' This postulate of course does not merely apply to *A, B*, and *C*. Rather it defines the ideal type 'poker player.'" (Schutz, 1972 [1932]: 186)

Hacking's analysis can be extended to address the general question of agency and its relationship to collectivity. Much like Butler, Hacking argues that agency is fundamentally linked with collective practice. As descriptions of not just qualities but also possibilities of action, human kinds have a direct influence upon the locus of possibilities for any single subject's agency:

> As human kinds are made and moulded, the field of descriptions changes and so do the actions that I can perform, i.e. the field of human kinds affects the field of possible intentional actions. (Hacking, 1995: 368)
>
> Who we are is not only what we did, do and will do but also what we might have done and may do. Making up people changes the space of possibilities for personhood. (Hacking 1999a: 165)

Hacking's argument thus extends beyond self-understanding to incorporate practice as well. He argues that collective referential practice has an inevitable influence upon the locus of intelligible practices assigned to any given category of subjects. Agency—tentatively conceptualized as the possibility of practice—is bounded and enabled by collective practices of reference and categorization.

Hacking's work on dynamic nominalism provides this study with some important arguments. First, he notes the social contingencies of subjectivity, as well as the manner in which collectives enable and sustain particular variations of subject positions through classification—a central thesis of my research. Second, he argues that interaction exists between the kind and the subject, insofar as subjects are responsive to, and alter the character of, the kinds that define their very subjectivity. This claim adds an entirely new dimension of concept application to PTSI; it makes evident the dialectical relationship between subjects and their subjectivities, insofar as subjects can actively take up subject positions and alter them. This strengthens my analysis and further distinguishes between artefacts—the topic of Chapter Four—and subjects—my present concern. Third, he notes the interrelation between agency and structure—much as do Butler, Foucault, and Barnes—in that agency is enabled and curtailed by the formation of kinds, a collective practice.

5.3.4 Taking stock

I have covered a range of material, all of which engages with the question of subjectivity in relation to collective practice. Kusch's argument concerning the collective and self-

referential nature of the 'I' brings a communitarian epistemology to bear upon questions of privileged first-person access. Foucault's and Butler's works on power and the subject analyze the relationships between collective practice and subject formation; furthermore, they render a communitarian conceptualization of agency. Hacking's work with dynamic nominalism addresses the question of self-knowledge as responsive to the collective and the active reaction of subjects to the communal practices of classification.

These respond to the four problems I identify in discussing the unique character of subjects for a communitarian epistemology. *Self-knowledge is developed within and exists by virtue of social 'embeddedness'; agency is a product of collective practices and cannot be understood otherwise; subjects perform their subjectivities in response to collective practices; collective practices adjust to singular acts of performativity.*

These four responses are critically important to my argument regarding subjects and subjectivities, as well as to my broader sociophilosophical approach to artefacts, subjects, and bodies. While subjects display unique difficulties, these are not insurmountable, and the Edinburgh School's communitarian epistemology is useful for addressing these topics. Moreover, analyses of agency and self-knowledge shed light on the collective origins subjectivity and aid this study.

5.4 Masculinity and the aged subject[149]

As with Chapter Four and heteronormativity, I here address subjectivities in relation to a social order, namely that of age and ageing. Age is a social phenomenon as omnipresent and influential as gender and, like the latter, age is centrally involved in the constitution of subjectivities in technological practices. Moreover, it serves as a crucial factor in the constitution of masculinities in Latin America, as I demonstrate below. Here I substantiate one claim: *subjects are enabled in relation to technological artefacts and knowledge in a fashion that reflects age and ageing.* This case material documents and my analysis explicates the relationships between age, ageing, and subjectivity in Latin America, and the role played by technology in mediating and enabling subject positions in relation to age. This material evidences my claim about the collective character of subjects and subjectivities by

[149] My use of the term 'aged subject' is not pejorative. I employ it much as social and political research employs the modifier 'gendered'. That is, I use 'aged' to indicate a subject who, by virtue of a subject position, is situated with respect to beliefs, presuppositions, expectations, and responsibilities corresponding to broad conventions regarding age.

presenting additional empirical evidence. Additionally, I discuss the manner in which self-knowledge and agency are collective phenomena.

Much as I did in Chapter Four, I contextualize my empirical work through a brief review of the relevant literature—in this case on age. I first discuss work on the social character of age and ageing. I then draw upon the literature on age, masculinities, and Latin America to develop a conceptualization of the interplay between the three. Finally, I articulate my own empirical argument and summarize its key implications.

5.4.1 Studies of age, ageing, and subjectivity

Social studies of age and ageing—sometimes referred to as social gerontology—constitute a range of research problems, methodologies, and theories, all of which attempt to study the concept, order, and experiences of ageing. Often, studies attempt to problematize the relationship between age and subjectivity. For the purposes of this thesis, the question of age, ageing, and subjectivity is the most important aspect of social gerontology. This brief review identifies and summarizes some key observations and conclusions drawn from the literature on ageing as a social phenomenon.

First, social studies of ageing have drawn attention to the importance of temporality[150], as well as its omission within mainstream sociological research (Gullette, 2004). Much as feminist studies once struggled to incorporate the 'question of gender' into social and political research, students of age and ageing have attempted to develop a similar 'turn'—one focused on reconciling contemporary streams of research with a concern for age and ageing. One difficulty of this methodological and theoretical move is the laboriousness of applying a constructivist analysis to the question of age:

> Age may be the hardest of the body-linked constructs to dispute because two of its properties, change and continuity, seem unavoidable and yet, when considered together, contradictory. (Gullette, 2004: 107)

More important perhaps is developing the necessary methodologies with which to account for temporality in the study of subjectivity. Gullete argues that a fundamental change is

[150] For a discussion of temporality from the Edinburgh School, see Barnes, 2004. For a phenomenological argument concerning temporality and Being, see Heidegger, 2005 [1927]; for one on temporality and intersubjectivity, see Schutz, 1972 [1932], Chapter 4, section C, sub-section 33.

required in order for sociological studies of subjectivity to appreciate the principal importance of time:

> Each story and the accumulated, comprehensive self could be called, without confusion, 'age identity'… aging is the *ground of possibility* of developing any identities at all. (Gullette, 2004: 129, emphasis original)

Broadly speaking, social and political studies are developing the necessary tools, although age remains a specialized niche of research and an under-represented facet of social life.

Second, as with most social research, studies of age and ageing display considerable empirical contradiction and analytic variation. Ageing, in terms of social interaction, emotional experience, and embodiment, is complex and problematic, and not amenable to simplistic models of linear temporal change (Barnes & Parry, 2004; Farrell & Rosenberg, 1981; Heikkinen, 2004). Rather than focus on temporal markers, studies of age and ageing examine the mechanisms via which different, often contradictory, experiences of age and ageing are constituted and the symbols (Neugarten et al., 1965) and institutions (McVittie et al., 2008) that help establish 'aged' subjectivities. The myriad approaches to the study of ageing (see Bond & Coleman, 1990) have resulted in a multi-faceted analytic tradition, with considerable tensions.

Third, studies of ageing have engaged with the question of subjectivity by examining such phenomena as multiplicity (Kunneman, 1997), change (Gullete, 2004), and normativity (Neugarten at al., 1965). These approaches empirically and analytically demonstrate the necessity of further research into subjectivity and ageing. Additionally, these studies substantiate the earlier claim to the importance of time and change in subjectivation. These observations regarding subjectivity open the way to robust examinations of the role played by the material world—in this case technological artefacts—in enabling, constraining, and sustaining social orders and subject positions.

Fourth, this research reveals the overwhelmingly negative portrayal of ageing in contemporary Western society. Age—and more specifically, 'old age'—is depicted in negatively stereotyped manners. The pervasive 'narrative of decline', which stresses the physical, cognitive, and social deterioration of the ageing subject, exists as a central component of Western social life (Farrell & Rosenberg, 1981; Gullette, 2004; Kunneman, 1997). This permeating discourse renders ageing as an undesirable inevitability to be

combated and postponed. Ageing is often described—popularly and in academic literature—as a process of 'identity stripping' by which subjects lose their identity to time and disease (Barnes & Parry, 2004; McVittie et al., 2008). In opposition to this portrayal, other research—including my own—stresses the inherent *change* in subjectivity associated with all moments of a subject's life, rather than the loss of subject position as a facet of 'old age'. Finally, the discourse of decline stresses 'alienation', the notion that ageing is a process by which subjects become less and less attached to society writ large[151].

Age and ageing are social phenomena, and while physiological changes occur, their categorization—as well as that of the individual into an 'aged' subject position—is a social process responsive to conventions and self-referential in character. It is here that studies of age and ageing find their concordance with the Edinburgh School: analytically, age and ageing are problems of categorization and concept application. Age is a permeating social order—a compelling phenomenon with which to develop a Strong Programme analysis of subjects as collective accomplishments.

As an under-explored facet of social life, ageing is an exciting field of research. Its relationships with gender are varied and sociologically important (see Farrell & Rosenberg, 1981; van der Hoonaard, 2007). Its intersections with technology—while empirically and analytically absent from the discipline—are in all likelihood as complex and varied as those of gender and technology. Before I engage with my study of gender, ageing, and artefacts, I will complement this limited review with a discussion of age, masculinities, and Latin America.

5.4.2 Age, masculinities, and Latin America

The conventional character of subjectivity demands that subjects be studied in relation to, and within the context of, their localized communities. While my case material contributes the vast majority of this information, I intend to contextualize my work within studies of age

[151] A consequence of this facet has been the development of critical gerontology—critical ageing studies. Like its counterparts in studies of gender and ethnicity, critical ageing studies aims to undermine and fundamentally change social perceptions of age and ageing. Gullette calls for subversive narratives of ageing (2004), which resolve to undermine dominant discourses of decline and deterioration. While such efforts have received little attention in wider circles of social and political research, the progressive character of such projects is an important facet of social studies of ageing.

and masculinities in Latin America. This brief review improves the quality of my sociological account, and serve to expand and situate specific points made above.

As with much of the literature on age and ageing, studies of age in Latin America focus particularly on *old age* rather than the general process of ageing. Consequently, this review is divided into two components. The first considers the role that work and employment play in the constitution of Latin American masculinities. I explore the idealized role of fatherhood and 'breadwinning', their relationship to the heteronormative family, and changing patterns of work and masculinities. In doing so, I document a central component of men's life courses in Latin America, as well as a significant instigator of major life transitions. I then explore masculinities, old age, and vulnerability. I discuss retirement, the role of the aged father, and the transition to dependency. This second sub-section expands upon my discussion of work, but also addresses the relationships between ageing and fatherhood, the family more broadly, and subjectivity. These are critically important topics throughout my empirical study below.

Research into masculinities in Latin America—both that of other scholars as well as my own—consistently identifies work as a central practice and space in the acquisition and maintenance of socially-valuated masculine subjectivities[152]. The relationship between employment and masculinities is immanent in other social phenomena found in studies of gender and/in Latin America, including the household and men's domination. Importantly, work comes to define masculinity for the vast majority of men's lives, and is present even in its absence, as I discuss when considering retirement. As would be expected, masculinities in Latin America are temporally dynamic, and different social phenomena influence the constitution of masculinities during different ages. However, the family and work become relevant fairly early in most men's lives. Chant and Craske write:

> … different aspects of 'manliness' are important at different stages of the lifecycle. Among young Peruvian males, virility is the main route to affirmation of masculinity, but as men enter adulthood, work becomes more important as they aspire to be family providers. (Chant & Craske, 2003: 168-169)

Work is the idealized, prototypical practice for men in Latin America. Not only does work—along with other social phenomena such as politics—define the masculinized character of the

[152] Again, drawing from Foucault, it might be possible to refer to the workplace as a 'surface of emergence' for the object of masculinity in Latin America (1972 [1969]). Other surfaces, such as the church and the family, have been empirically identified as complicit in this valuation of employment.

public sphere, it also defines the manner in which men as construed are heads of family. Fuller argues:

> The public sphere sustains and legitimises masculine predominance… Within this sphere, work is represented as the key dimension of *adult masculine identity*. To enter the world of work means and implies the acquisition of the status of adulthood, it is a prerequisite for establishing a family and the principal source of social recognition. An adult man who fails to obtain a job which is considered adequate and prestigious by the peer group can annul the significance of any other form of personal achievement… (Fuller, 2000: 97, my emphasis)

Work is the axis of valuated masculinities. Without engaging in work, men's privileged social status disintegrates, both in the public sphere as well as the domain of the family, another fundamental component of Latin American masculinities. Researching Costa Rica, Chant notes:

> As Luis, a thirty-three-year-old waiter put it, for a man who cannot undertake to provide for his wife and children, his self-image and his image in the eyes of others *ya no vale nada* (isn't worth anything). (Chant, 2004: 356)

Work defines successful masculine subjectivities during adulthood—and consequently defines the longest period of most men's lives in Latin America. Work is also related to the heteronormative ideal of father/breadwinner.

As I note in Chapter Four, the heteronormative imperative present in Latin America idealizes femininity as motherhood and masculinity as 'breadwinning'. Men's authority over women and children within the family is a function of providing for them through work. Writes Fuller:

> … men hold authority within the family because they are supposed to sustain and provide for all its members. (Fuller, 2000: 98)

With regard to subjectivity, the father/breadwinner subject position is one dependent upon conventional notions of the household, of men's and women's places in the public sphere of work, and the selfsame heteronormative ideals I discuss in Chapter Four. Masculine subjectivity vis-à-vis fatherhood is often linked to the practice of work:

> From the domestic point of view, the man defines himself as the provider and the person who is responsible for the family. (Fuller, 2000: 97)

> Both younger men and women with whom we spoke believed that Mexican men's most significant family role is still that of breadwinner. Men are judged, and judge themselves, on how successful they have been as providers for their families during their working lives. (Varley & Blasco, 2000: 124-125)

Conventions regarding the structure of the family, expectations concerning work, and the practice of financial provision are all involved in the constitution of masculine subjectivities in Latin America, both in terms of collective attribution and self-knowledge. Of course, there exists an evolution of these concepts of masculinity. Latin American masculinities are subject to changing patterns (Viveros Vigoya, 2001), and Chant has documented the specific transformation of Costa Rican masculinities (Chant, 2004), whereby female employment has begun to challenge overarching notions of masculinities and the public sphere. Nevertheless, my above arguments concerning work still hold significant sway, and are particularly important with my participants, most of whom are middle-aged men.

Unsurprisingly, the significance placed upon work and the 'breadwinner' ideal has substantial effects during and after retirement and throughout old age. As an event in the lifecycle of men, retirement is of paramount importance. Write Varley & Blasco:

> … men's 'loss of responsibility' is not only about historical change. It is also part of the life course. Even older men who remains economically active are likely either to lose the main breadwinner role to someone else or to find it increasingly difficult to provide for their family. (Varley & Blasco, 2000: 120)

The end of work fundamentally alters the relationships between masculinities and the family. As work is symbolically and logistically involved in the constitution of the 'breadwinner' subjectivity during the largest bloc of most men's lives, the transition from provider to dependant is a difficult, even painful, period. The progression is one that dramatically alters the character of individual men's subject positions:

> Whereas for younger men the home symbolises their success in the struggle to support a family, other meanings may come to the fore when they are older. Men can lose self-worth when they retire and find themselves spending unprecedented amounts of time in the home. (Varley & Blasco, 2000: 130)

> For men, the trouble with the provider role—other than its being so difficult to live up to—is that it is over-specialised. In so rigidly prioritising men's financial contributions to family life it equates caring with cash. (Varley & Blasco, 2000: 134)

Retirement and old age reconstitute the expectations made of the subject, and consequently alter his relationship to the heteronormative household. The most important practice for

defining masculine subjectivities (work) is no longer available, and the second most important one (fatherhood) fundamentally changes in character because of the loss of the former and children becoming self-funding adults. Precarious and oftentimes insufficient pensions provided by Latin American welfare states also contribute to a general feeling of uselessness and vulnerability among older men[153] (Chant & Craske, 2003).

This discussion identifies a series of important conclusions from studies of age, masculinities, and Latin America. First, work is a central practice and space within which valuated masculinities are forged. Second, the most critical subjectivities expected of men are those of the 'breadwinner', which are directly linked to work. Last, the loss of these subjectivities due to retirement is often a difficult transition during the lifecycle. I use these arguments in my empirical work, which details the manners in which technology is implicated in aged subjectivities.

5.4.3 Men, ageing and the motorcycle

Above I address the issue of age as a social order. The remainder of this chapter is dedicated to studying the relationships between age, technology, and masculine subjectivities. This empirical section substantiates one primary claim: *subjects are enabled in relation to technological artefacts and knowledge in a fashion that reflects age and ageing*. While the sociology of age and ageing has addressed issues of age and subjectivities, studies of masculinities and ageing are comparably recent (van den Hoonaard, 2007), and little, if any, literature on ageing and technology exists[154]. In studying the relationships between masculinities, age, and technological artefacts, I am helping to correct this problem. This case material also substantiates three secondary claims.

First, age is a fundamental component of subjectivation. As I argue, subjectivities are conventional phenomena; the character of any particular subject position is a function of social practices and beliefs. My case material demonstrates that age permeates the ontological constitution of technological artefacts and the subjectivities associated with these machines.

[153] While the lack of substantial pensions is a phenomenon that affects women much more significantly than it does men (see Chant & Craske, 2003; Martínez Franzoni & Camacho, 2007), it is nevertheless an important issue in considering older men's feeling of vulnerability.
[154] For one example, see Cushman and Klecun, 2006.

Second, the lifecycle of a subject involves numerous subjectivities and technological artefacts. Age is a dynamic, continuous, and conventional phenomenon. During the lifecycles of men, subjectivities are constantly reappraised, altered, and maintained; the social order of age is centrally involved in the enabling of subject positions. Similarly, technological artefacts are interpreted by communities as acceptable or unseemly for different ages, and social beliefs regarding age are important in considering the use or non-use of technologies across subjects' lives.

Third, subjects' self-knowledge is informed by age and technological artefacts. Agency and self-knowledge are responsive to all forms of convention, including those of age and ageing. Similarly, technological artefacts are involved in the constitution of self-knowledge and in the enabling and constraining of agency. My study illustrates the links between age and self-knowledge, as well as the importance of technological artefacts with regard to subjects' agency.

Substantiating my primary and secondary claims allows me to demonstrate further several arguments I develop earlier in this chapter, and also contributes to various strands of social and political research. I provide further empirical and analytic work for the sociology of ageing and add to the still-limited scholarship on masculinities and ageing. With regard to studies of Latin America, this thesis advances existing literature and adds new analytic work. Most importantly, this case material significantly contributes to the sociology of technology by documenting the importance of age in the social enquiry on technological artefacts. Though not comprehensive—and certainly not definitive—this empirical work contributes substantially to this discipline.

This section contains three components, each of which addresses a specific facet of my argument. First, I document the manner in which ageing is involved in changing subjectivities, and the ways with which technological artefacts respond to these transitions. Second, I address select and often-discussed life transitions, paying particular attention to retirement, the end of care-giving, and the pursuit of new subjectivities through technological artefacts. Third, I explore the manner in which technological artefacts and social notions of age are complicit in the constitution of self-knowledge and agency.

5.4.4 Changing lives / changing machines

Earlier in this section I note the importance of examining age and ageing as processes extending across the lifecycle, rather than as properties simply associated with *old* age. This statement follows not only from critical age studies (see Gullette, 2004), but also from my earlier claim that age constitutes a central component of subjectivation. My empirical work on the topic further strengthens the argument towards a comprehensive study of ageing and subjectivity.

Age—conceptualized both as a chronological phenomenon as well as a collection of privileges, responsibilities, and expectations—is present in the constitution of subject positions. The accounts of motorcyclists' lives I collected unquestionably demonstrate that subject positions change throughout subjects' lives, and that these changing subjectivities are manifest in and constituted in relation to technological artefacts. Changing machines reflect changing lives. In the first—and most narrow sense—age functions to delimit technical properties. Growing up, as rudimentarily chronological, occurs by growing out of certain machines and growing into others. In the second sense of age and changing subjectivities, the choice of machine is a function of more than simply size and physical strength[155]—the privileges, responsibilities and expectations of any particular age inform the choice of motorcycle. In both manners, subjectivities are 'aged'; in both manners, this phenomenon is manifest in technology.

The interview participants' technological autobiographies[156] oftentimes centred around the gradual learning process by which they moved away from their initial forays into motorcycling. In these narratives of growing up, the participants discussed ageing as a fundamentally chronological phenomenon—a series of linear events across their lifetime. Each new motorcycle is a milestone in both growing up and growing into a new—more powerful—machine. As the motorcyclists grew older, the machines almost certainly grew larger:

[155] Physical strength (clearly) relates to issues or corporeality and the body. I discuss the limiting/limited body and embodied age in Chapter Six.
[156] C.f. Kennedy, 2003.

> "I had a Yamaha 50, that was the first bike, one year. Then I had an 80 for about two years. Then I had a 125 like another year, and my parents were too scared by the bike." (CR-03, 54 yrs., BMW GS 1200)[157]

> "… I rode a bike at 16 in Colombia and I've had a whole evolution of bikes from a 65 cc, then I passed to a 150, then to a 175 cc, a 350, a 500, a 750, and now I have a 1200…" (CR-25, 54 yrs., BMW GS 1200)

The physical capacity to control larger and larger engine sizes, combined with parental approval of (and income to fund) such machines and the 'nerve' to ride them, functions as an indicator of growth. For both CR-03 and CR-25—self-described 'lifelong' motorcyclists—growing up was characterized by gradually increasing engine sizes. However, each transition from one motorcycle to the next was more than a machinic rite of passage. Technological passion, physical pleasure, and new methods to articulate a more technically-competent masculinity were immanent in each step. Increasing engine size and chronological growth also implied a new interactional status amongst peers[158]. This status, based on machinic competence, is one earned through *becoming* competent—yet another temporal phenomenon[159]. Ultimately, the nomenclature of motorcycle engines dominates accounts of growing up; for the participants, age is often measured in cubic centimetres.

The question of ageing is complicated by concepts of responsibility, privilege, and expectation, all of which allow the analyst to explore in greater detail the relationships between subjectivities, age, and technology. While for most motorcyclists engine size remains a constant indicator of growth, a number of participants further qualified this claim by drawing upon notions of age-specific responsibilities and opportunities. CR-05, age 43, draws upon both engine size and the notion of age-specific status in saying:

> "I stared when I had 12 years, approximately. I had a neighbour, where I lived in Escazú[160], who had a mini-bike. A 70 cc automatic Honda. It was a fantasy for any kid of that age… When I was 27, I was just graduated. I had my own job, and I could even take my own decisions without the need for my family to be in the middle. So I took the first decision to buy a 400 cc bike, which for me was huge next to the 70… I liked it a lot and from there I passed to, so from 400 to 600, then the 900, then we stopped at 1400 with the cruiser bikes and then we passed to what I have today." (CR-05, 43 yrs., BMW RT 1200)

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[157] Note that I have included each participant's age after his quotation. As all participants in this empirical module are male, I have not noted their sex. Their age is that at the time of interviewing, which occurred between July and October, 2007.
[158] Bourdieu's notion of 'social capital' is relevant here (2002 [1972] & 1984 [1979]).
[159] And one linked to training (see Barnes, 1982).
[160] A suburb of San José.

This quotation synthesizes both my earlier concern with engine size as a discursive and physical proxy for ageing and my current concern with age as a collection of responsibilities, privileges, and expectations. In order to further explore the latter, I discuss one specific case—that of CR-14—which is both representative and sufficiently nuanced for my immediate concerns. A 'lifelong' rider, CR-14 has experienced a varied range of motorcycling equipment and practice. When prompted for his technological autobiography, he replied:

> "… the mini-bike was like my first, my first step… from there I passed to an 80 [cc], and the 80 had a clutch, had everything and was a motocross bike and there I started to go up mountains, getting away from the house, 15 years old, another thing. Much more definitively, much more involved in the sport, right? The sport of motorcycling, more than just riding a bike, right? Basically that was it, those were the changes there, then I started with enduros, 125, 200, and I left motocross. To start to cruise, right? Travel… After the enduro, which was still a city bike and a bike for travel I started with high-cc bikes. My first high-cc bike was a 500 Kawasaki and with that bike I started another thing. Girlfriends, travelling, beaches, and I was a surfer. Then, well I started to travel around the country with the 500. After that it was increasing, increasing, increasing motor size… When I went to live in the United States, to the state of Florida, I bought another 750 at the end of university… I went to live in Miami and now, imagine, I had another age, another economic level as a person, I wasn't a student. I had my own company. I bought a Honda CRV 1000 and raced, right? I had speed bikes… I've had, since then until now, when I'm 46, I've had bikes and I've ridden. I've been in Costa Rica and in Costa Rica I love having a bike and travelling all over Costa Rica… to do cross-country…" (CR-14, 46 yrs., BMR GS Adventure 1200)

Much as the previous participants, CR-14 notes the constant desire to increase engine size, and this measurement characterizes his account of growing up. More importantly, this participant notes that each age bracket he defines belonged to a different machine and a different set of motivations and motorcycling practices. After learning to ride, the youthful CR-14 practiced motocross. Soon after, in later adolescence, he began to ride larger motorcycles and participate in surfing and romantic liaisons. After university, during early adulthood, he engaged in speed motorcycling. Now, at 46, he enjoys more tourist-oriented motorcycling. Each of his 'ages' was characterized by engine size, machine category, and riding practices; moreover, these reflected the character of his personal life and his perceptions of appropriate practices for his age at the time. The adolescent boy, interested in girlfriends, adventure, and getting away from his home, rides a motorcycle with a large engine. The post-university entrepreneur rides speed motorcycles during a period of excess and little, if any, family commitments. The married man in his forties gives up speed for tourism, lone riding for trips with his wife, pure machinic adrenaline for the pleasure of

travel and tourism. His geographic location—Costa Rica—contributes to his formation of a 'tourist' subjectivity, insofar as his machine is congruent with the locales he intends to visit and the practices of eco-tourism he enjoys[161]. These 'aged' expectations and privileges are manifest in the technological artefact and practices of the subject, whose subjectivity is constituted in relation to both age and the artefact.

Both these modes of age, change, and technology provide initial evidence of the relationships between age, ageing, and technological artefacts. In its most rudimentary form—chronological linearity—age is manifest as a series of changing motorcycles. Larger and larger engine sizes stand as representatives for increasing age, and the machine is used as an indicator for competence and growth. In the second, more nuanced, articulation of age, the motorcycle is embedded in a series of age-specific practices. In this, age and ageing are more than simple measurements of time, and rather come to constitute a series of responsibilities, privileges, expectations, and desires. The technological artefact is centrally involved in the practice of these social phenomena and is itself ontologically constituted in relation to age. As concerns the questions I pose here, the subject position of any single motorcyclist is a function of age and technology. Moreover, these subjectivities are multiple and continuously negotiated. Finally, in discussing their growth and 'aged' subjectivities, each motorcyclist draws upon the artefact as an indicator of age and ageing.

Note that in both cases presented here, age is a function of categorization. Subjects are classified—and classify themselves—according to social schemata of age and ageing. Classification is at the core of the ontological constitution of subjects and the social order of age.

5.4.5 Work, family, and new subjectivities

In addition to its omnipresent character, age also appeared in the participants' accounts of motorcycling and subjectivity in relation to more distinct occurrences. Alongside the notion of age as a generalized phenomenon—a continuous process of adjustment and subjective re-negotiation—numerous participants identified important milestones in their personal lives that motivated their choice to engage with motorcycling. Most notably, participants often addressed the importance of major life transitions as catalysts for their excitement in motorcycling or as events that re-ignited a dormant passion for riding.

[161] I discuss motorcycling and the connection to nature in Chapter Six.

The commonality between the various life transitions noted by the participants is the transition from one subjectivity to another, and the arduous process of adjustment sometimes required by such a change. The most frequently discussed events were those of retirement and the end of early parenting. For the various men in my study who discussed these transitions—all in their late forties or fifties—the end of work and/or the end of care-giving[162] were fundamentally disruptive occurrences that demanded a renegotiation of subject positions. As the subjects each found their positions as workers and parents challenged by evolving circumstances, they developed new subjectivities in the realm of motorcycling. Often simplistically and pejoratively described as 'mid-life crises', these transitions in subjectivity are in fact sociologically significant and centrally important in the study of age and technology. Here, I examine the participants' accounts of these events and discuss the manner in which technological artefacts are involved in this facet of subjectivity. First, I discuss the importance of fatherhood and the curtailment of care-giving in relation to 'aged' subjectivities and technological artefacts. Second, I document and analyze the transition from work to retirement and the use of artefacts in creating a new, work-independent subjectivities.

Recall that the family operates as one of several key institutions within which masculine subjectivities are enabled, assumed, and maintained. Above, I argue that research on masculinities and Latin America unquestionably indicates the significance of fatherhood and the 'breadwinner' subject position to the valuation of masculine subjectivities, and the difficulties encountered when such practices are challenged or begin to evolve. Often, male participants discussed the significance of their children growing older as a milestone in their lives associated with their taking up motorcycling:

> "Well, my kids were adolescents… I was thinking that I was almost done raising the kids, that they weren't kids anymore, they were adolescents or pre-adolescents." (CR-26, 57 yrs., Honda Shadow 500)
>
> "My kids, I have two sons, are already at, at university age… I am 51, my wife is 45, so we already passed the stage of raising the kids." (CR-27, 51 yrs., Harley-Davidson Roadking 1338)
>
> "… for many years of my life I thought that personal fulfilment was very important… so maybe you lean a little to that part that's personal satisfaction, I mean your wife, your kids, etcetera. And well that was a time on which I had great

[162] For most participants, the end of care-giving came with their children's enrolment in university, first full-time job, and/or moving away.

> satisfaction of being able to travel, of being able to share with my family, of seeing your kids grow up. But once they reach the age of independence, you realize that that couldn't completely satisfy you. I mean, they were momentary situations, right?" (CR-09, 50 yrs., BMW GS Adventure 1200)

These three men all note the perceived 'end' of care-giving—the important transition from dedicated parenting to their children's independence. For CR-26 and CR-27, the role of parent is one beginning to transition as their children grow from adolescence to young adulthood; for CR-09, this transition is all but complete, and there is a clear absence of the parental subject position. He has found a new realm of possibilities with regard to subjectivity, one of which is enabled through the motorcycle and its associated social practices. These three men articulate a common phenomenon amongst older motorcyclists; the transition from dedicated fatherhood to hands-off parenting oftentimes results in a new or re-invigorated passion for motorcycling:

> "So like motorcycle [*sic*], is something that, going back to motorcycle [*sic*] was sort of trying to find myself again, I mean like, in a different stage of my life, when my kids where not all in the house anymore, where the whole structure of life has changed from you know, eh, planning everything around, you know, you have kids and you're going to go do things with them to the fact that they've grown up, they're studying outside, including the relationship with my partner changed…" (CR-01, 56 yrs., BMW GS 1200)[163]

> "… I started to ride when I was 41, when my kids were graduating high school. They don't want to go out with me anymore. So, I had a great void, because I'm very attached to my kids. When they were small, I played with them, I would pick them up, we'd go to the stadium, I was very attached to them. So at that moment I was feeling a great void which was my kids' late adolescence… principally that's what was marking my life." (CR-21, 44 yrs., Harley-Davidson Sportster 883)

For CR-01, the change in the character of fatherhood resulted in displaced subjectivity. His interest in motorcycling was re-ignited upon his youngest child's departure to university in the United States. In the motorcycle and the collective practices of the BMW Motorclub, he found such a new subject position. Comparably, CR-21 found that to satisfy what he felt to be a 'void' in purpose, he needed a new manner in which to be a subject, and motorcycling enabled a new subjectivity. The five men above all experienced the difficult transition discussed by the various authors I cite in sub-section 5.4.3. For them, a technological artefact was centrally involved in responding to the transition from one age-based subjectivity to another. Motorcycling provided a space within which to assume a subject position to replace the loss of such a foundational subjectivity as that of fatherhood.

[163] Again, most of this interview was conducted in English. This is not a translated passage.

Similarly—and confirming the work of previous scholars in studies of masculinities and Latin America—the transition from work to retirement proved a significant and transformative event for several participants. In the same manner that the subject position of father became dislodged with children's ageing, the subjectivities associated with work came to an end with retirement. Two participants noted the effect that this change in profession had upon their subject positions when responding to a question on major life events:

> "I worked for 10 years for [company name][164] and then as a result of the sale of the manufacturing operations which [company name] had in Costa Rica I had to separate myself and so I was also experiencing a substantial transformation of my life." (CR-21, 44 yrs., Harley-Davidson Sportster 883)

> "So it was a change and among the changes that I wanted to make for my personal satisfaction, after working for other people's need for so many years, I thought I'd do two weird things. First, learn how to fly fish, fly fishing. And two, I bought a bike, which seems to me more sensible than buying a red convertible, which all of the 50-year-olds buy themselves." (CR-22, 51 yrs., Honda Goldwing 1832)

For CR-21, the end of employment, his transition to sometime-consultant and occasional university lecturer—along with his above-mentioned end of care-giving—was a significantly challenging experience. Similarly, CR-22 ended his career as a lawyer and became a marginally-involved partner and consultant for his law firm. In his case, he identified various ways to develop new subject positions through hobbies and interests. CR-21 and CR-22 both adapted to a new lifestyle of semi-retirement, one in which work no longer commands the primacy it previously did nor demands the same commitment of time. For these two men—whose work had previously held a dominant place in their lives—the transition to a new balance of work, family, and leisure proved to be a chance to reconstitute themselves[165]. As I summarized above, Fuller (2000) and Varley and Blasco (2000) note that the end of work is also the end of men's most significant subject position. Work is a substantially important space for the enabling of subjectivities, and forms the basis upon which other subject positions are enabled. For the men in my study, retirement often became a challenge to conquer, a situation that prompted the discovery of new subjectivities. Those I interviewed found new subject positions in motorcycling.

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[164] The name of CR-21's company has been omitted for anonymity. The participant's expertise lies in international business, and he has worked with a variety of corporations as a consultant or full-time employee to that effect.

[165] Using Foucault, it is possible to conceptualize this transition as a transition from one set of 'practices of the self' to another—thus altering self-knowledge and normative behaviour as well (Foucault, 1990 [1984]).

My participants noted the importance of singular periods in ageing by referring to parenting and work. The loss (or transformation) of two subject positions of fundamental importance to Latin American masculinities prompted the men in my study to rediscover their own subjectivities and somehow 'repair' the change[166]. This need to reposition and recalibrate the subject indicates that subjectivities must constantly be reappraised, altered, and maintained, as I suggested above. Moreover, it lends credence to my argument that subjectivities are multiple and responsive to the phenomena of age and ageing. Finally, the role that technological artefacts play in mediating the transitions I discussed here indicates that technologies can be centrally involved in the enabling of 'aged' subjectivities.

5.4.6 Self-knowledge, accepted practices, and agency

Finally, this case material addresses the constitution of subjects' self-knowledge and the manners in which self-knowledge enables and constrains agency. My research indicates that for motorcyclists, age is a central facet of self-knowledge. Participants consistently drew upon social conventions regarding age to justify certain choices of technological artefacts, discuss their engagement in or avoidance of specific motorcycling practices, and characterize their use of particular motorcycles as appropriate or inappropriate. When mobilized during the interviews, age and ageing functioned as mechanisms of delimitation and justification. My participants often felt compelled to argue the case for a particular style of motorcycle—or at the very least to contextualize it in terms of age—and to situate their use of the technological artefact within age expectation. In doing so, they articulate their self-knowledge as subjects, the influence of social expectations upon this form of understanding, and the manner in which both age and technological artefacts become inescapably involved in subjectivity.

Self-knowledge is not separable from collective social practices. Just as artefacts become intelligible as 'aged', so self-knowledge is enabled in relation to age and technology. Age as a set of responsibilities, privileges, and expectations significantly influences a subject's self-understanding and practice[167]. These in turn influence the manner in which technological artefacts are used and understood, which directly affects the constitution of artefact ontology.

[166] Even for men still employed, motorcycling offered a new space for subjectivities. Often, the participants characterized riding as a chance to escape the routine of everyday work, an opportunity for true 'self-realization', and a venue for mental reprieve from daily stress.
[167] Recall my discussion of Hacking, above.

Here I discuss two facets of this phenomenon. First, I describe the manner in which 'aged' self-knowledge affects subjects' comprehension of motorcycles, and the corresponding influence of this upon the artefacts' intelligibility as 'aged' machines. Second, I discuss the influence of social conventions regarding age upon accepted practices and agency. Discussing these issues satisfies and substantiates my earlier claims regarding the communitarian character of self-knowledge and agency.

In selecting a particular style of motorcycle, the participants often considered age-specific expectations and patterns of behaviour. In following such normative standards, my participants were not only assuming 'aged' subject positions, they were reinforcing social conventions concerning age and ageing. Moreover, by repeatedly characterizing certain machines as appropriate or inappropriate artefacts for a particular age category, they were enabling the artefacts' ontologies and their own subjectivities in relation to each other and within the context of localized social practices. For the participants, the choice of machine reflected the motorcyclist's understanding of him/herself as an 'aged' subject:

> "Age and bike style go hand in hand." (CR-11, 51 yrs., unspecified BMW)
>
> "The BMW is more traditional. I catalogue it as a bike for people who are located in their age, understand? People who are 50 and feel 50. On the other hand, other bikes make you feel younger, Harleys especially." (CR-24, 55 yrs., Harley-Davidson Sportster 883)

For CR-11, age operates as a fixed determinant of motorcycle use. While in his younger days he had driven a sportsbike, he now owns a more 'conservative' style of motorcycle. His repeated comments on the influence of age upon motorcycling reveal a linear and degenerative understanding of a motorcyclist's riding capabilities. Age determines the appropriate machine, and invariably constrains choice. CR-24 offers a more nuanced discussion of age, self-knowledge, and technological artefacts. Unlike the former participant's deterministic model of aging, CR-24 argues that age is more dynamic than the linear passage of time. Rather, age is a factor of self-understanding and practice. While CR-24 does not elide physical limitations, he argues that technological artefacts can be used to perform a subversive age subjectivity. CR-11, the owner and manager of a large plantation, conforms to conventional notions of age in clothing, behaviour, and technologies; CR-24, the owner and manager of a small motorcycling supplies store, challenges traditional concepts of ageing through his use of leather clothing, expressive tattoos, rings, and necklaces, and (importantly) his choice of motorcycle. These two participants' self-

knowledge is invariably informed by age, ageing, and technology, but in starkly different ways. Such diversity evidences my claim to the conventionality and collectivity of subject positions, as well as the individual idiosyncrasy present in all communities and social institutions. While social orders may be extensive, they find distinctive articulations at the local level.

For other participants, age is more immanent in the ontological constitution of the technological artefact. Certain machines are intelligible in relation to certain age categories; concurrently, certain subjectivities are intelligible in relation to certain machines because of age considerations. These distinctions and classifications of machines and motorcyclists often took the form of arguments concerning appropriateness. Participants qualified certain artefacts as normatively correct or incorrect for specific age groups:

> "The one I have is more formal, let's say, in terms of its looks, right? More, more gentlemanly, let's put it that way. It's not a bike maybe that would get the attention of a guy of 25 years, younger than 20 or 30, let's say." (CR-27, 51 yrs., Harley-Davidson Roadking 1338)

> "The structure of the bike, that one that's really a sportsbike I like a lot. I think that it's a bike for you, a bike for someone of thirty to forty years, a sportsbike, strong." (CR-11, 51 yrs., unspecified BMW)

Both these participants adamantly noted that different artefacts 'make sense' for different ages. As such, artefact ontologies are responsive to age and ageing. More importantly, both motorcyclists articulated their belief of age-appropriateness within the context of the subject. Both CR-27 and CR-11 displayed fairly conservative opinions of ageing, and understood themselves as behaving 'appropriately' for their age—that is, in concert with societal conventions of age. This conformity extends to their choice of motorcycle. They explicitly distanced themselves from 'youthful' machines by referencing sportsbikes as technologies of subjects younger than them. Thus, the agent-artefact relationship is of paramount importance in these accounts, as the 'aged' subjectivity of the motorcyclist is inextricably linked with the 'aged' ontology of the machine. This facet of the empirical data illustrates the manner in which social conventions surrounding age delimit the field of possible technological choices. Moreover, the quotations demonstrate clearly the relationship between the social order of age, systems of age classification, and the ontological constitution of artefacts and subjects.

It is possible to further examine the importance of age in relation to self-knowledge and subjectivity by exploring the manner in which age enables or constrains particular facets of

subjective agency. As I note in my earlier examples within this sub-section, age is centrally involved in the capacitation of subjects with self-knowledge. Moreover, I demonstrate the role of technological artefacts in this process. One final component of this phenomenon is the manner in which self-knowledge regarding age and technology influences the realm of possible practice. While I have examined this process in relation to the choice of artefact, the empirical data suggests that agency is also constrained in relation to the type of riding itself. Various participants noted the influence of age as a social status upon their motorcycling practices:

> "Well, for me, I'm not about going and getting muddy, I'm too old for that and besides, all of my friends who have done motocross have broken something… I'm old enough to enjoy long rides and so what I looked for was a touring bike." (CR-22, 51 yrs., Honda Goldwing 1832)

> "At the beginning you are young so, what you like is adrenaline, jumping on bikes, crossing rivers, riding in the mountains, and all of that. And as the years go by you go situating yourself, what's it called? Until you get to this type of bike, which is a bike where you enjoy more. What you look for are good roads." (CR-24, 55 yrs., Harley-Davidson Sportster 883)

'Aged' subject positions delimit the range of possible practices. A subject whose status is that of a 'middle-aged' motorcyclist is expected to participate in specific practices and avoid more 'youthful' ones such as speed biking or enduro motorcycling[168]. CR-22 and CR-24—a touring motorcycle rider and a Harley-Davidson motorcyclist, respectively—both enjoy long rides on machines designed for comfort, not speed or off-road riding. While such delimitations of agency are clearly generalizations—and exceptions to the rule are not infrequent—there does exist substantial collective pressure to conform to particular styles of motorcycling. The participants are 'aged' in subjectivity and agency insofar as they modify their practices to conform to the expectations of 'middle-age'. Pressure from family members, friends, fellow motorcyclists, and their own self-understanding leads these men to engage in age-specific practices. More fundamentally, age as a classificatory schema is a collective good, and seeking to behave appropriately with regard to others' age classification is seeking to behave in accordance with a collectively-constituted system of rules. Conversely, a participant like CR-34 continues to ride mountain trails despite the social pressure to curtail such practices. Exceptions are present, but age-informed conformity is

[168] Notice the conventional character of age classification. Outside the motorcycling community, all motorcycling might be —and often is—considered dangerous for 'middle-aged' people. Within the community, the classification of age-appropriate activities is substantially different.

ubiquitous. These various examples illustrate the manner in which age influences self-knowledge, and by extension agency, in relation to technological practices.

The various aspects of this sub-section—self-knowledge, ontological ageing, and delimitation of agency—elucidate the relationships between age, ageing, and subjectivity with particular emphasis upon the phenomena of self-knowledge and agency. Moreover, these empirical examples substantiate my earlier concern with self-knowledge, agency, and the collective. Responsibilities, privileges, and expectations—all social phenomena linked to age and ageing—are paramount in self-knowledge and agency, two ostensibly individualistic phenomena.

5.4.7 Some implications

This study of age, subjectivity, and technological artefacts demonstrates the social basis of subjectivities and, consequently, the analytic benefits of studying subjects as artificial kinds. Moreover, the empirical data contributes greatly in emphasizing the importance of age and ageing within the sociology of technology. My central claim within this section was the following: *subjects are enabled in relation to technological artefacts and knowledge in a fashion that reflects age and ageing*. In empirically demonstrating the validity of this claim, I demonstrate in further detail the usefulness of a PTSI approach to the question of subjects and subjectivities, and resolved a number of questions posed throughout my argument. Here I provide an overview of what has been accomplished and the implications of this analysis.

With respect to age and ageing, this case study provides evidence for a range of significant issues. I demonstrate the central role played by age in the process of subjectivation. The empirical data suggests that motorcyclists assume specific subjectivities that are—among other things—characterized by age categories. Importantly, age and subjectivities are conventional phenomena. Throughout any single subject's lifetime, subjectivities must constantly be reappraised, altered, and maintained vis-à-vis age. This observation lends further credence to my argument regarding the social bases of subjectivity. Lastly, I note the manner in which age influences a subject's self-understanding and self-perception.

As an empirical study on subjects and subjectivities, this work substantiates several of my secondary claims from earlier in the chapter. Subject positions are products of collective practices and knowledge. Norms regulating age-specific phenomena—constituted and

maintained by communities—are critical in enabling specific subjectivities. As I demonstrate, conventional notions of age distinguish collective expectations, and affect the manner in which individuals negotiate their acquisition of subject positions. Additionally, these subjectivities are not separable from the agent-artefact relationship. The use of technological artefacts in particular manners is a central facet of subjectivity, and in considering 'aged' subject positions, the normatively correct use of technology is of considerable importance. Finally, this study of subjectivity provided original empirical evidence to substantiate my earlier discussion of self-knowledge and agency as collectively-constituted phenomena. Any one subject's understanding of his/her self is a function of those responsibilities, privileges, and expectations that the community establishes as immanent to that discrete subject position—even if the subject is constituting his/her subjectivity in opposition to the community. This final item is necessarily linked to agency, as the locus of possible action is enabled and curtailed by collectives and forms a fundamental component of any subject's self-understanding.

5.5 The communitarian subject

Subjectivities are social institutions, and all subjects can be analyzed as artificial kinds. Using both empirical data and theoretical argumentation, I demonstrate the usefulness of such an approach above. Subjects—individuals embedded in social interaction—are products of social practice. The physical individual exists as a material entity outside of society, but does not possess any of the properties which we—as a collective—attribute to the subject. As social institutions, subject positions display conventionality, self-referentiality, performativity, collectivity, and normativity. Thus it is possible to understand subject positions as social-kind statuses attributed by and intelligible only within collective social practice. Along with the materiality of the individual, this suffices to analyze subjects as artificial kinds.

Two major problems arise from this conceptualization, which can be succinctly described as those of agency and self-knowledge. A communitarian epistemology of subjectivities must somehow account for the unique properties of subjects implied by these two phenomena. Through a variety of arguments, I note that the conception of 'I'—both as a nominal term and as a mechanism for self-ascription—is a collective good. Additionally, agency is enabled and constrained by collective practices. Finally, self-knowledge is inevitably influenced by

collective practices of classification, just as it influences the very classification that established the subject in the first place.

As a result, sociological studies of subjects and subjectivity must address collective practices, and the manner in which social orders—such as gender, sexuality, and age—influence the constitution of subjectivities and constrain self-knowledge and agency in particular ways. This methodological and analytic claim follows from my above arguments and from the Strong Programme's communitarian epistemology. Subjects are functions of collective practice, just as collectives can be identified by the various subjectivities to which they give rise. As I noted of the comparable dialectic regarding artefacts and communities, subjects and collectives are interrelated phenomena. Barnes's analyses of 'status groups' (1992 and 1995) offers a similar interpretation; all 'status groups' define, demand, and sustain specific subject positions, and can be sociologically identified by the subjectivities they enable and the practices those subjectivities entail.

Subject formation, as a process that occurs only within societies, is necessarily susceptible to the particularities of collectives—and importantly, social orders such as age. Dominant beliefs and practices delimit the possibilities of subject formation. Butler writes:

> This work on the self, this act of delimiting, takes place within the context of a set of norms that precede and exceed the subject. These are invested with power and recalcitrance, setting the limits to what will be considered to be an intelligible formation of the subject within a given historical scheme of things. There is no making of oneself (*poiesis*) outside of a mode of subjectivation (*assujettisement*) and, hence, no self-making outside of the norms that orchestrate the possible forms that a subject may take. (Butler, 2005: 17)

Subjects are functions of society and are characterized by the conventional beliefs and practices of the communities that enable the subjectivities under examination. Subjects are communitarian phenomena.

Like artefacts, subjects are underdetermined by their materiality. Nevertheless—and much as I noted in concluding Chapter Four—it is imperative to recognize that subject positions are ontologies rendered intelligible in relation to a number of other ontologies. Importantly, 'aged' subjectivities are constituted in relation to the corporeal process of ageing, and subjects' self-knowledge is often predicated on embodied experience and self-understanding. Thus, while underdetermined by the material, subjects are unavoidably constituted in relation to it. As such, the above study of ageing has elided a central phenomenon in the

ontological constitution of subjects. An analysis of corporealities and bodies is required to remedy this fault.

Chapter Six: Bodies

In Chapters Four and Five, I explore artefact ontologies and subject positions using the Performative Theory of Social Institutions, working at length to demonstrate that these display the five characteristics of social institutions. Moreover, I argue that technological artefacts and subjects are amenable to sociophilosophical analysis as artificial kinds. In doing so, I necessarily encounter and note the problem of materiality—both with respect to artefacts and to subjects. As my concern hitherto has been with ontologies as social-kind statuses, I introduce but do not scrutinize technological materiality and subjective corporeality. Doing so was not an indication of ambivalence or indifference to the questions raised by materiality; it was a consequence of the unique problems associated with the sociological study of the body. Rather than append a brief consideration of materiality and corporeality to the chapters on artefacts and subject, respectively, I here develop a dedicated argument concerning the body—the third and final component of my analysis

Like artefacts and subjects, the body has received substantial interest, and has been researched, documented, and theorized from a variety of perspectives, including: anthropological (Bourdieu, 2002 [1972]; Mauss 1973 [1935]), historical (Foucault, 2003 [1963]; Laqueur, 1992), feminist (Butler, 1993; Fausto-Sterling, 1992), philosophical (Merleau-Ponty, 2006 [1945]), psychological (Stam, 1998; Wilson, 2004), cultural studies (Carden-Coyne, 2004) and sociological (Howson, 2004). This literature on the body is both expansive and rich in nuance; moreover, this field of enquiry continues to produce innovative work of high calibre.

In this chapter I draw upon this tradition of research in rendering a communitarian account of the body and in advocating the importance of embodied knowledge, practices, and experiences in the sociological study of technological artefacts. I review arguments that demonstrate the applicability of PTSI in order to finalize the tripartite argument begun in Chapter Four. Much as I explore technological artefacts and subjects through Kusch's concept of the artificial kind, I analyze bodies in a comparable and compatible fashion—that is, as communitarian phenomena rendered intelligible in and through social interaction. My analysis of bodies as artificial kinds is substantially similar to my argument concerning subjects and subjectivities insofar as it stands in opposition to individualistic accounts of embodiment.

Once again, I am compelled to establish an analytic vocabulary with which to engage the question of the body. Fortunately, the delineation of concepts is congruent with that between individuals and subjects in Chapter Five. For the purposes of my analysis here, *corporeality* refers to the physical substrate, the unclassified physical entity that supports our existence, with which we move through the world, and through which we gather sensorial data[169]. The *body* is socially-situated. Unlike 'pure' corporeality, the *body* is always classified in myriad interconnected ways (including but not limited to sex, age, attractiveness, and strength). That is, the *body* is *corporeality* in social interaction and characterized by numerous classificatory schemata. This ostensible division between nature and culture is somewhat more complex than my initial definitions indicate. I am *not* arguing that physical corporeality serves as simply the canvas upon which social practice unproblematically paints the cultural body (see Butler, 1989). The relationships between corporeality, the body, social practice, and embodied knowledge, practice, and experience are manifold and complex. These I explore below. For now, it is sufficient to accept an *analytic* partition between the socially-independent and the socially-dependent, much as I did with materiality/artefacts and individuals/subjects.

This chapter does not conform to the same structure as Chapters Four and Five. Simply stated, this is because previous work has already been undertaken in developing a PTSI analysis of the body (Rafanell, 2003; Crozier, forthcoming). As such, the chapter follows a modified line of argumentation. First, I outline a series of considerations that underlie much of the literature on, and my own analysis of, the body. I then consider the question of bodies as artificial kinds, but instead of developing an argument drawn from my own research, I summarize the work of Irene Rafanell, whose doctoral thesis accomplished precisely the task of rendering the body as an artificial kind. Finally, I give an empirical account of machinic embodiment, and explore corporeal and sensory experience, concepts of machinic hybridity, and the body as a limiting factor in motorcycling.

6.1 Bodies: Premises and postulates

As a prelude to my summary of Rafanell's work on bodies as artificial kinds, I must identify and appraise some key claims from social studies of the body. As I am constrained by space

[169] "Bodily existence which runs through me, yet does so independently of me, is only the barest raw material of a genuine presence in the world. Yet at least it provides the possibility of such presence, and establishes our first consonance with the world." (Merleau-Ponty, 2006 [1945]: 192)

and the specific aims of this thesis, a comprehensive and definite discussion of the body is not possible here. Nevertheless, I must establish the premises underlying my work. First, corporeality is not self-categorizing; put otherwise, corporeal physicality underdetermines the systems of classification by which bodies are enabled and constrained. Second, bodies are contingent phenomena. Third, bodies are both objective and subjective phenomena. The complex relationships between 'having-a-body', 'using-a-body', and 'being-a-body' are crucial sociological considerations. Fourth, the phenomenological body is deeply consequential in studies of embodiment.

6.1.1 Corporeality is not self-categorizing

Bodies are socially-situated and communally-intelligible insofar as they are categorized within collectively-constituted systems of classification. Outside of social practice, classificatory knowledge does not exist and *a fortiori* neither do classified entities such as bodies. Instead, there exist unorganized occurances and entities. The enduring physicality of the corporeal persists, but it exists as all *unclassified* natural-kind entities—outwith the bounds of conventional knowledge and practice. Importantly, this material substrate—the corporeal—does not self-categorize; classification is a social process.

Foucault's works on clinical medicine and taxonomy address the critical disjunction between 'raw' physicality and knowledge about the material world. In exploring the burgeoning practices of the clinic, Foucault documents the development of sign- and symptom-based medical practices (2003 [1963]). Crucially, he notes the conventional character of signs, and the social and historical processes by which inert physicality comes to represent and signify disease through the development of specific forms of social practice. Foucault's work on the development of taxonomy further validates this claim. Writing about the consolidation of classificatory systems, Foucault states:

> … on the one side, we shall find the signs that have become tools of analysis, marks of identity and difference, principles whereby things can be reduced to order, keys for a taxonomy; and, on the other, the empirical and murmuring resemblance of things, that unreacting similitude that lies beneath thought and furnishes the infinite raw material for divisions and distributions. (Foucault, 2006 [1966]: 64)

Systems of categorization of natural materiality are necessarily conventional phenomena. The natural does not classify itself, and holds no interest in or preference for any single taxonomical system (Barnes, 1981a).

Feminist studies of the body have contributed greatly to validating this premise, particularly in efforts aimed at deconstructing the illusory inevitability of dichotomous sex categorization. Feminist and gender studies scholars have produced voluminous quantities of research arguing that the binary division of bodies into male and female is a conventional phenomenon[170]. While schools and traditions of feminism differ in their advocacy of and adherence to a constructivist rendering of the sexed body, most authors reject fundamental natural properties of sex as an essentialist—and therefore counterproductive—analysis of the body. Philosopher Moira Gatens argues:

> The female body cannot provide the ontological foundation required by those who assert an essential sexual difference. On the contrary, it is the construction of biological discourse as being able to provide this status that is in need of analysis. (Gatens, 1996: 71)

Much as Foucault argued for the ontological limitations posed by the natural world, Gatens argues that body categories are conventional through and through. Comparably, Oudshoorn's study of endocrinology documents the manner in which bodies became 'naturalized' through the developing science of hormones, and the ramification that such a discipline had for the binary division of sexed bodies (Oudshoorn, 1994).

Finally, the Strong Programme advocates this premise. In discussing classification and concept application, Barnes notes the fundamental importance of the natural world, but qualifies this argument by noting the necessarily limited influence that natural 'reality' has upon our categorization of this world. In a statement that seems to echo directly Foucault's work on taxonomy, Barnes writes:

> 'Reality' does not mind how we cluster it; 'reality' is simply the massively complex array of unverbalized information which we cluster. (Barnes, 1981a: 33)

Natural entities are entirely indifferent to our assignation of concepts and classificatory schemata.

The corporeal is simply another in the array of material entities we encounter. Consequently, our underlying corporeal physicality does not determine, compel, or prefer a particular set of

[170] See e.g. Butler, 1993; Fausto-Sterling, 1992; Gatens, 1996; Grosz, 1994; Oudshoorn, 1994; Schiebinger, 1993.

divisions and classifications. The body—dependent upon such classificatory systems—is thus not an unproblematic result of natural materiality.

6.1.2 Bodies are contingent

An initial and crucially important consequence of my above claim is the contingency of bodies. Much as my claim in Chapter Five regarding the contingency of subjectivities, the premise here concerning bodies is not a radical or revolutionary proposition. A great deal of work in the study of the body has demonstrated the social, historical, and cultural contingencies of the body. This work provides a crucial basis upon which to argue for a communitarian epistemology of the body.

Thomas Laqueur's historical study of the sexed body demonstrates the historically-contingent character of sexual classification in the Western world (1992)[171]. By drawing attention to the steadily transforming classificatory scheme of the human body, Laqueur problematizes our apparently-natural and ahistoric binary of male and female bodies. While human corporeality has remained effectively equivalent since the earliest Greek anatomists, numerous classification systems have been developed, proffered, accepted, and eventually rejected for new paradigms. Each system has brought into existence different bodies from equivalent natural materiality. The bodies of Galen are not the bodies of endocrinology.

Similarly, Gaten's work on the body argues that there exists an intractable nexus of knowledge, practice, and bodies. Social beliefs, practices, and expectations are centrally involved in the ontological constitution of specific bodies, and are in no way a product of asocial corporeality. Writes Gatens:

> The body of a woman confined to the role of wife/mother/domestic worker, for example, is invested with particular desires, capacities, and forms that have little in common with the body of a female Olympic athlete. In this case biological commonality fails to account for the specificity of these two bodies. (Gatens, 1996: 69)

Social convention and contingent systems of classification ultimately predominate over the material similitude of corporeality. Bodies—invested with the "desires, capacities, and forms" noted by Gatens above—are contingent phenomena.

[171] For a debate concerning Laqueur's work on the history of the body, see Stolberg, 2003; Laqueur, 2003; and Schiebinger, 2003.

Finally, I should note the substantial contributions of symbolic interactionism to this specific claim regarding bodies and corporeality. In placing emphasis upon the role of social interaction and the constitutive power of intersubjectivity, symbolic interactionist scholars such as Goffman (1990 [1959]) have demonstrated the prevalence of social dynamics in the constitution of meaning. Social expectations, beliefs, and meanings influence not only our classification of bodies, but also the very manner in which we *use* our bodies and the implications this usage has for our understanding of those very bodies[172].

6.1.3 Bodies are both objective and subjective

The simultaneous objectivity and subjectivity of the body is the most counterintuitive of these premises. The concurrent existence of the body as an object to experience, observe, and modify and as a subjectively-experienced entity is a central facet of all social studies of the body[173], and contributes to my examination of the body as social product, corporeal matter, and lived experience.

Numerous studies of body-building and other practices involving 'body-projects' elucidate the objectified character of the body, as an entity to be observed and judged as well as an object to be transformed, improved, and modified to specific physical standards. Carden-Coyne's study of body-building in the post-war years (2004) convincingly argues that the practices involved in muscle-building, alongside advertisements for exercise regimes, transformed the body into a system of signifying modules. Muscles became representative of overall physical prowess. Moreover, the body became a site of physical transformation, an object to alter and improve. Gill, Henwood, and McLean (2005) argue that 'body-projects' such as body-building and cosmetic surgery transform the corporeal into a semiotic mechanism, whereby social values, expectations, and norms may be represented by the material constitution of the body. These authors also note the importance of the body as a vehicle with which to signify subjectivities, thus addressing the importance of the body as a subjective entity.

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[172] There exists, of course, a dialectic relationship between practice and convention, which I explore below.

[173] On the subjective body: "The living body is a subject, too. It is us, we: for it is as embodied that we are human beings. So the body is the fleshy condition for, or, better, the fleshy situatedness of, our modes of living." (Mol & Law, 2004: 43)

Grosz (1994), drawing upon the phenomenological tradition of Merleau-Ponty (2006 [1945]), addresses the tension between body as object and body as experience in a synthetic approach. All subjects possess a body upon which they can enact change, and with which they can signify to others (that is, the body as an object for others); concurrently, the body exists as a lived experience for the subject (that is, the body as a fundamental component of subjectivity). These two facets are not discrete and dissociable. Rather, as Merleau-Ponty argues, each is immanent in the existence of the other, and together constitute the basis for subjective existence.

In examining the body and gender differentiation, Lindemann (1996) explores the myriad relationships between body as object and subjective experience. She develops a series of categorizations of the body by which she deconstructs the various facets of embodiment, from the fundamental material constitution of the body to the set of knowledge claims regarding any particular kind of body. Importantly for my immediate concern here, she notes the interrelation between object and experience, and contributes a concern for knowledge:

> … knowledge—in a concrete or vivid form—about the objectified body and the experienced body have a relationship of reciprocal meaning… In other words, having knowledge of which objectified body I have means to me that I know how my experienced body is constituted. (Lindemann, 1996: 352-353)

Lindemann's argument encompasses a series of critical observations for this study of the body. The distinction between 'objectified' and 'experienced' bodies echoes my above partition, and in Lindemann's work the complex interplay—and ultimate inseparability—of the two is explored in detail. More importantly, her work on knowledge contributes to my claim regarding the importance of classification in the ontological constitution of the body.

6.1.4 The phenomenological body matters

The socially-situated and constituted body must be supplemented with an analysis appreciative of the body as a sensorial apparatus and as a vehicle with which and through which we encounter and comprehend the world. This concern for the perceiving and experiencing body is manifestly important for any robust analysis of the body in society, and is necessary when researching the physical interplay between bodies and technological artefacts.

Maurice Merleau-Ponty's work with phenomenology (2006 [1945]) is unquestionably important in addressing the body, physical experience, and sensorial apprehension. In his *Phenomenology of Perception*, Merleau-Ponty engages at length with various aspects of corporeal experience. Most relevant here is his interpretation and pervasive use of the concept 'being-in-the-world'[174]. As I suggest earlier in discussing Grosz's work on the body, Merleau-Ponty posits a fundamental unity between mind and body—in direct challenge of the Cartesian duality—in order to elucidate the importance of the corporeal in subjects' interaction with the world. Succinctly, the phenomenologist argues that the body provides the subject with the requisite mechanisms for experiencing, interacting with, and comprehending the world—both natural and social. As such, subjects are always physically situated within their corporeality and in relation to the world:

> Truth does not 'inhabit' only 'the inner man', or more accurately, there is no inner man, man is in the world, and only in the world does he know himself. (Merleau-Ponty, 2006 [1945]: xii)

'Being-in-the-world' as a foundational condition of human beings is the basis for perception, subjectivity, and intersubjectivity. Additionally, Merleau-Ponty stresses the importance of the body as an apparatus for sensorial apprehension:

> My body is the fabric into which all objects are woven, and it is, at least in relation to the perceived world, the general instrument of my 'comprehension'. (Merleau-Ponty, 2006 [1945]: 273)

Our understanding of all entities is enabled and tempered by the corporeal. The phenomenological argument thus provides us with an appreciation of corporeality as a foundational condition and as a vehicle for sensorial and conceptual comprehension.

Importantly, while phenomenology is considerably individualistic, it is amenable to the communitarian epistemology employed throughout this thesis. As I demonstrate in section 6.3 below, corporeal experience and sensory perception are not self-categorizing phenomena. Thus for 'purely' phenomenological events and experiences to become comprehensible, they require conventional systems of categorization[175].

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[174] On the concept of 'Being' (and particularly *Dasein*) see Heidegger, 2005 [1927].

[175] For a comprehensive study, see Schutz, 1972 [1932], Chapter Two. For a summary and application of this argument, see 6.3.3 and 6.3.4 below. This line of arguments is also similar to that employed by Kusch in studying folk psychology (1997 and 1999).

The authors of the Strong Programme similarly recognize the necessity of accounting for sense experience and perception in the constitution of knowledge claims. In addressing the conventional character of knowledge and cognition, Barnes notes several times that a foundational requisite for the production of knowledge claims is the capacity to perceptually apprehend the world. It is by virtue of this basic mechanism that knowledge claims are developed and taught:

> The child cannot acquire his knowledge of bird kinds without parental assistance; but neither can he acquire it with his eyes shut. (Barnes, 1982: 25)

The social practice of parental instruction is dependent upon the sensorial act of perception; the two are equally pivotal in the growth of knowledge. As Merleau-Ponty argues, the perceiving body is our vehicle of interaction with the world, and sensory experience is a critical facet of corporeality.

6.2 Bodies are A-kinds[176]

This chapter is set apart from those on technological artefacts and subjects in that the analytic work to conceptualize bodies as artificial kinds has been undertaken previously; accordingly, my established process of piecemeal argumentation—which I use to demonstrate the artificial-kind character of artefacts and subjects—is not employed here. In its stead, I summarize and discuss the work of Irene Rafanell, whose analysis of the sexed body makes use of the Performative Theory of Social Institutions in recasting the body as an artificial kind and collective accomplishment. Although Rafanell's work is an expansive analysis of various approaches to the sociology of the sexed body, I focus upon her specific injunctions concerning the use of PTSI.

Rafanell's thesis consists of a critical reappraisal of Pierre Bourdieu's notion of 'habitus' vis-à-vis the Strong Programme's Performative Theory of Social Institutions. Drawing from further scholars—notably, Foucault and Butler—Rafanell undertakes to deconstruct 'habitus' and illustrate the analytic superiority of PTSI. While her examination of Bourdieu is certainly interesting, it serves no function within this thesis and consequently is elided. I rather focus on detailing the major components of her use of the Strong Programme and her argument concerning bodies as artificial kinds. This section is structured according to the major propositions immanent to Rafanell's analysis. I first explore the material basis of the

[176] Unless otherwise noted, this section draws upon Rafanell, 2003.

body in corporeality; second, I discuss the importance of knowledge—and specifically classification—in the ontological constitution of the body; third, I note the collective character of bodily practice; last, I examine the manner in which conventional knowledge affects the materiality of the body and subjects' embodied agency.

6.2.1 Corporeality underdetermines the body

Rafanell's study of the sexed body—alongside a number of feminist works that deal with the issue of corporeality and sex/gender—devotes a considerable portion of its argument in negotiating the relationship between nature and society, between physiology and the classified body. In deploying the concept of artificial kinds, the author explicitly aims to elucidate the social character of the body while at the same time retaining a sensitivity towards the 'raw' physicality of the corporeal. It is her intention to account for and discredit the apparently natural and asocial dichotomization of bodies into binary sex categories. Succinctly stated, Rafanell claims—as I do for technological artefacts and subjects—that the 'purely' physical necessarily underdetermines the ontology of the body. The corporeal is a requisite but not sufficient condition for our understanding of bodies.

I identify this line of argumentation above in noting that corporeality is not self-categorizing—it is indifferent materiality. Drawing from Foucault, Gatens, and Barnes, I discuss the manner in which similitude and classification are not obvious in or proffered by nature itself.

Focusing on the classification of bodies into the male/female binary, Rafanell argues that the physical substrate of the sexed body becomes an apparently unproblematic signifier for sex only once discursive practices of categorization undertake to establish specific body parts as signs or markers of sex. Corporeal features are signs if and only if they are socially constituted as such:

> … the apparently universal features which define our 'sexed' corporeality—reproductive capacities would probably feature centrally—need to be considered as the result of discursive performativity by which they are constituted as the 'relevant' sex categories. (Rafanell, 2003: 211)

Importantly, this analytic endeavour does not negate, elide, or circumvent the 'real' physicality of categorized bodies. Rafanell contends that bodies gain their intelligibility as a result of myriad social practices—verbal and otherwise; these establish the parameters

according to which we classify bodies as sexed in one particular fashion or another. While the corporeal is a necessary element in this classificatory practice, insofar as it exists as a causal element to our inductive processes, the underlying physicality of the body does not unproblematically determine its sexed categorization. Writes Rafanell:

> The 'matter' of the sexed body, thus, cannot be understood as pre-existing the materialization effected by the social terms and practices which describe it. This is not to deny a pre-existing physical reality outside our self-referring activity, but to understand that such reality does not provide us with a determinate meaning of how to interpret, understand and categorize it. (Rafanell, 2003: 214)

Bodies exist only after a degree of consensus emerges regarding the signifying status of particular body parts. That is, while the underlying physicality of the body enables all practices of classification, its classification into binaries is wholly a function of knowledge. Bodies emerge from productive discourse[177].

6.2.2 Bodies are functions of knowledge

The body is a function of knowledge and is performatively constituted through reference and physical practice, both of which are social, collectively-mediated practices. Rafanell's work demonstrates the manner in which knowledge is mobilized to discriminate corporealities into body categories. By employing PTSI, she extends the above argument concerning body parts and signification into an analysis of classification and referential practice. The performative character of reference further evidences the productive character of knowledge in the ontological constitution of sexed bodies without—as I have previously noted—losing sight of the corporeal. Finally, the Strong Programme's finitist sociology contributes an understanding of the body as contingent and continuously-constituted. This final point provides further proof of the conventionality, performativity, and normativity of the body. I address each point in turn.

The basis for body ontologies is classification. It is in the categorical divisions between male and female bodies that the very intelligibility of male and female bodies comes into existence. Put otherwise, the sexed body does not exist without knowledge of sex categories—a fundamentally social phenomenon. Writes Rafanell:

[177] C.f. Foucault on 'docile bodies' (1991 [1975], Part 3, Chapter 1)

> Under the conceptual lens of artificial kinds, the physical features which are taken to be central to our characterization of a female or a male body are shown to be relevant, and thus, come to exist in their full social status as a result of our discursive practices. Materiality becomes 'matter' and thus, becomes artefact in nature, as the result of a universe of taxonomic categories and actions. (Rafanell, 2003: 214)

Without "taxonomical categories and actions"—forms and functions of knowledge—corporeality is not capable of a signifying potential and the sexed body is non-existent. Once a community establishes and maintains specific knowledge claims concerning the classification of bodies and the meaning of particular corporeal parts, then sexed bodies attain their ontologies.

In reference to particular bodies as male or female, agents within the community bring into being and sustain the categories of sex. As with any social institution, the aggregate acts of single community members 'bootstrap' the concept into existence and produce the illusion of ahistoric and self-evident 'reality'. However, this 'reality' is inescapably a social phenomenon—regardless of its influence upon subjects' behaviour as that of an immutable property of the natural world. A Strong Programme approach allows us to reconcile the performative character of knowledge with the apparent obduracy and obviousness of categories such as 'sex':

> Barnes' work, let's recall, sees the nature and bases of social kinds of entities as self-referring social institutions. In other words the 'reality'—that is, the reference of the predicates—of these entities is constituted by the social practice of making references to them. However, his work not only accounts for 'social' knowledge but for *all* knowledge as a social institution. [These] include, cultural understandings and knowledge of a physical independent reality… A clearer picture emerges if we envisage the work of performative self-referential activity as constituting an artificial kind, that is, as those things whose identity—and shape—is defined by their role within a group who create such identity—and shape—through their practices. (Rafanell, 2003: 212-213)

In critically engaging with the Strong Programme's work on performativity, Rafanell accomplishes much the same as I demonstrated in Chapters Four and Five on artefacts and subjects, respectively. That is, that artificial kinds become intelligible as themselves only within the practices of specific collectives. Rafanell argues that the case of the sexed body is fundamentally similar.

Lastly, Rafanell discusses performativity in relation to the Strong Programme's finitism, which I outline in Chapter Three and apply analytically in Chapter Four. A finitist

understanding of the sexed body implies that acts of reference and physical practice continuously and reiteratively constitute the meanings upon which collective understandings of the sexed body are built. Much as the corporeal underdetermines the body, previous instances of reference to the sexed body underdetermine present and future usages of the various terms associated with the classificatory schema—the influence of these past instantiations of concept application is non-deterministic.

By emphasizing the importance of continuous acts of referential practice as well as the constitutive power of these acts, finitism further demonstrates the performative character of knowledge. Moreover, the non-deterministic relationship between previous acts of classification and present and future acts elucidates the conventional character of sexed bodies, as each act of categorization is influenced by the contingencies and particularities of the community within which that act occurs. Changes in the collective inevitably affect acts of classification, and consequently the character of our knowledge regarding the sexed body. Finally, the importance of sanctioning within finitism highlights the primacy of normativity in sustaining collective understanding of the divisions between male and female bodies. Like all social institutions, the ontology of the sexed body is one dependent upon mutual susceptibility and collective sanctioning.

6.2.3 Collective practice and bodily practice

The above sections summarize Rafanell's work on the relationships between corporeality, knowledge, and referential practice in the ontological constitution of sexed bodies. However, as she points out, a close focus on reference and acts of classification—while necessary in conceptualizing of bodies as artificial kinds—elides the importance and ubiquity of non-verbal practices. That is, focusing on the performative character of acts of classification has the unwanted consequence of diminishing the central role played by physical practice in the ontological constitution of the body. While Barnes' and Kusch's work on knowledge relies substantially on verbal utterances, any consideration of the body must incorporate an appreciation for embodiment. Rafanell analyzes the place of physical practice in a communitarian analysis of the sexed body in a variety of manners. Here I summarize two. First, I discuss Rafanell's argument concerning the manner in which conventional knowledge and practice have an obdurate physical effect upon the corporeality of the body. That is, I discuss the manner in which physicality—not just ontology—is subject to the

localized contingencies of community practice. Second, I discuss the manner in which physical practice is conventional.

Above I discuss the ontological repercussions of social practice upon corporeality; namely, classificatory schemata are responsible for the ontological constitution of the body. However, bodies are not simply products of verbal classification. Social practices also have physical repercussions upon corporeality, and acts of physical modification feature prominently in the communal enabling of a body's ontology. In her study of the sexed body, Rafanell discusses the *material* ramifications of classificatory activity:

> … culture creates bodies as artificial kinds through activity and a variety of mechanisms which shapes us physically: it constrains, forms, shapes, distributes, feeds, clothes, exercises and so on according to local conventional cultural conventions… (Rafanell, 2003: 215)

In the case of sexed bodies, physical transformation is starkly ubiquitous—not simply in products such as cosmetics or articles of clothing—which are unquestionably gendered phenomena—but also with respect to simple corporeal modifications such as haircuts or extreme corporeal changes such as cosmetic surgery, which often aims to enhance and exaggerate the physical signifiers for the ideal male or female body. Rafanell's claim concerning the physical implications of classification—the material consequences of knowledge and convention—is critical in (once again) emphasizing the importance of the corporeal.

In addition to the physical ramifications of categorization, Rafanell identifies and devotes considerable attention to bodily practice[178]. Rafanell argues that a Strong Programme approach must consider physical practices as effective of and influenced by classificatory systems. That is, the conventional sex dichotomy informs bodily practice, just as bodily practice operates performatively in the classification of sexed bodies. Non-verbal performativity is crucially important when considering the relationship between corporeality and the body. Writes Rafanell:

> Different cultural contexts present different taxonomies of bodily activity and movements which may be related to different sexes, so what may appear as a feminine or masculine body shape, movement or activity, in one culture may not be the same in another. (Rafanell, 2003: 217)

[178] Unquestionably, the significant emphasis upon physical practice is a consequence of the author's attempt to reconstitute Bourdieu's theory of 'habitus', a practice-centred framework.

Physical practices are subject to taxonomical systems. A particular gesture may signify masculinity or femininity, and is embedded within the collective classification of a specific body as male or female.

These two facets of the physical indicate that in considering the ontological constitution of the sexed body, corporeal shape and embodied practice are inescapable components of classificatory activity. Ultimately, both verbal and non-verbal instances of performativity are functions of knowledge and as such are social phenomena immanent in the categorization of corporealities into body types.

6.2.4 Knowledge, materiality, and agency

Communities have considerable influence upon the corporeal shape and physical practices of subjects as a consequence of collective taxonomical systems and acts of classification. Thus, subjects' physical practices and corporeality are oftentimes characterized by a dependence upon the collective and upon self-referential conventions. I discuss Rafanell's argument concerning these various points in the former sub-section, particularly with respect to the performative character of classification and non-verbal practices. A pertinent consequence of her analysis is that of the relationship between knowledge—in the form of classificatory schemata—materiality—in the guise of physical practices and corporeality—and agency. Much as I note the communitarian character of subjective agency in Chapter Five, Rafanell discusses the collective circumscription of bodily form and agency.

Classification and knowledge affect individual behaviour. As an artificial kind, the sexed body is not indifferent to the collective practice of categorization. Bodies *react* to their classification as male or female. Unlike reference to N-kinds, reference to A-kinds such as sexed bodies has interactive consequences:

> It changes, transforms and instigates new forms of activity according to the content of the categories which describe it. For example, a body categorized as 'female' will develop an array of practices in accord with the array of practices that is collectively believed to be what female body ought to behave and look like. (Rafanell, 2003: 218)

The 'sexing' of a body through concept application—here the concept 'female body'—results in a modification of that body's corporeality—a topic I explore above—and the

subject's embodied practices, from specific gestures to the body's gait. Collective stipulations as to the shape and behaviour of categorized bodies both enable and constrain the locus of possible physical practices. As such, the community is involved in the constitution of embodied agency and the body's corporeality. This relationship between structure and agency—community and subject—is comparable and analytically identical to that of communities and subjects explored in Chapter Five. Moreover, the interactive relationship between knowledge and practice—the influence of collective classification upon the subject's practices and corporeality—is congruent with Hacking's work on 'human kinds' (1999b). It is possible to extend his analysis of 'looping effects' (1995) to discuss classification, embodied practices, and corporeality.

Knowledge is pivotal in the enabling and constraining of embodied agency. Importantly, physical practice can also reinforce, challenge, or subvert dominant knowledge, insofar as embodied agency exceeds the systems of knowledge that enabled it. As both Butler and Hacking argue, agents can react against their classification into subjectivities, and the same is true of bodies and body ontologies.

6.2.5 Bodies are A-kinds

The various claims constituting Rafanell's sociophilosophical analysis convincingly demonstrate that the sexed body is an artificial kind. Corporeality—the material substrate of all bodies—fundamentally underdetermines the sexed body. The classificatory systems with which we dichotomize all bodies into male and female categories do not follow determinately from 'raw' human corporeality. Rather, our understanding of any particular body as sexed is a function of knowledge—concepts and categories—and practice—acts of classification and physical behaviour. It is in classifying materiality that bodies come to exist as intelligible in specific modalities—here, as sexed bodies. While the corporeal is undeniably an important component of the ontological constitution of the sexed body, the physical is always dependent upon knowledge for its ontology. Writes Rafanell:

> … 'objective' knowledge and the idea of an 'objective' reality is the result of a dual interaction with both the physical environment and our social context. We know the physical world with and through society, with the network and systems in place of self-referential knowledge categories. Thus objective and practical knowledge is always the result of the mediation between our cultural institutions and the impact of a physical reality which only becomes known via our categories. In this sense what we take to be 'reality' exists but in a sense has no existence independent of our collective thoughts about it. (Rafanell, 2003: 219)

The classification of a particular corporeality as a male of female body is the very process of constituting that body's ontology. Specific body parts come to exist as signifiers for a sex category as a result of knowledge. The various social institutions that sustain the classificatory systems of male and female bodies operate in such a way as to make the binary appear self-evident, ahistoric, and independent of social dynamics. Put otherwise, the social institution of the sexed body, when used to classify specific bodies, produces an impression of irreducible reality. Moreover, this process of classification comes to influence and effect change upon the very corporeality it is categorizing. Our classifying activity proscribes the shape that male and female bodies should and must take, influences our interpretation of embodied practices as indicators of a particular sex, and enables and constrains the range of possible embodied practices as functions of a body's sex.

The property of being-a-body is a product of knowledge and practice. Rafanell summarizes the point as follows:

> … the sexed body is an 'artefact' kind of reality in the sense that it is transformed by the self-referential process and becomes another independent materiality. Society is involved in constructing the body at the level of its 'knowability' as well as at the level of its corporeal delimitation. Social practices not only categorize the body but act upon it. Under the artificial kind theory the synthesis between nature and society is better accomplished. External material reality is taken into account by the artificial kinds theory, but not understood as pre-existing our categories about it (naive realism). (Rafanell, 2003: 236)

The categories that precede our understanding of the sexed body are not immutable, inalterable, or fixed components of 'reality.' We rely upon categorization and classification. While material reality is taken into account, it does not unproblematically and infallibly determine the sexed category into which any one body falls.

Sexed bodies are alter-referential insofar as corporeality exists and self-referential with regards to their ontologies. Thus, Rafanell's analysis demonstrates that sexed bodies are artificial kinds.

6.2.6 From sexed bodies to all bodies

Rafanell's use of the Strong Programme—although contextualized within and deeply relevant to the sociology of the body writ large—focuses on the problem of the sexed and

gendered body rather than the question of all bodies. Her emphasis upon the sexed and gendered body allows for an impressive degree of nuance and detail, particularly in relation to situating the work within a tradition of feminist scholarship. However, Rafanell's decision constrains her ability to engage more broadly with the question of the body in society, and while her work is unquestionably applicable to this topic, it is not explicitly directed at it. The present chapter is not concerned with the sexed body, but *all* bodies. I develop an understanding of bodies as collective goods, as objects and experiences made intelligible within communities and through social interaction. While the enterprise may appear ambitious for a single chapter, Rafanell's extensive study has already laid the foundation for my argument. Here I forward some ideas on the manner in which Rafanell's study of the sexed and gendered body—and as such, the Performative Theory of Social Institutions—is applicable in the broader study of the body.

First, Rafanell's account of the sexed body relies on the realist ontology of the Strong Programme, which commits the analyst to a series of fundamental propositions, including the existence of a physical reality 'out there'. With regard to the body, this is a pivotal claim and its significance should not be underestimated. Without a commitment to corporeality, a set of vital concerns—including sensorial apprehension, embodied experience, and physical practice—are ignored or at best given cursory attention. Physical pain and pleasure—alongside other corporeal phenomena—can and should be studied as what they are: *both* physical *and* social events. Occurrences and experiences of this sort are not circumscribed by the question of sex and gender, but are found in society writ large. Moreover, the semiotic function of the material in acts of classification is of paramount importance to social phenomena beyond sex and gender, and should be studied as such.

Second, as the sexed body is an artificial kind, its ontology is a function of social practice—it is a social institution. This line of argumentation should be familiar to the reader of this thesis, given my aims in Chapters Four and Five, and is one that functions considerably well in studying the body outside the particular domain of sex and gender. While the Strong Programme's realist ontology demands a commitment to the material existence of the corporeal, outside the realm of social interaction, physical corporeality is 'raw' material. Our interaction with, and understanding and experience of bodies are collective accomplishments.

Third, and following directly from the previous, bodies' ontologies are fundamentally linked with classification. Just as subject positions provide the basis upon which subjects gain their intelligibility as agents in social interaction, bodies are understood, shaped, and experienced in specific, socially-situated ways as a consequence of their incorporation into a taxonomical system. Rafanell demonstrates the success of this analysis in relation to the categorization of bodies as male or female. However, bodies are categorized within myriad systems extending beyond the sex dichotomy. Bodies are functions of age, class, desire, aesthetics, athleticism, grace, and strength, to name some examples. The multitude of classificatory schemata through which the body is rendered intelligible thus extends beyond sex and gender. Bodily classifications are numerous, overlapping, contradictory, in tension, and dynamic; in studying the body, the analyst must recognize the multiplicity of body ontologies (see Mol, 2002), just as studies of subjects must examine multiple subject positions. While the various classifications most often operate in more complex manners than the sexual binary—for instance, age is not a dichotomous category—they are nevertheless amenable to a PTSI analysis.

Fourth, Rafanell's work emphasizes the primacy and constitutive capacity of normativity. In discussing the sexed body, Rafanell refers to the 'constitutive role of sanctioning', whereby communal sanctioning of deviance maintains deference to the collective standard, reinforces mutual policing, and reiteratively consolidates the pre-eminence of the accepted practice. Normative standards exist for all bodies, and include expectations concerning a range of sociological phenomena such as those I address with respect to classification above. We not only expect 'male' bodies to look and move a particular way, but we expect 'old' bodies to look and move in specific manners. Deviation is surprising and normatively sanctioned. Moreover, as I discuss in Chapter Five, the following of group standards—that is, *not* deviating from the norm—is as important as instances of sanctioning, particularly from a finitist understanding of conventions and rules. In conforming to communal expectations of shape, knowledge, and practice, bodies gain their intelligibility as particular kinds of bodies—including but not limited to sex and gender. Moreover, as I note for artefacts and subjects, conformity is not exact and deviation is unavoidable. Thus while sanctioning is ubiquitous, it does not affect all bodies equally, and not all agents possess the same degree of power in shaping the social order.

In moving from the sexed body to the body, I can make one fundamental claim explicit: *the intelligibility of the body is a matter of knowledge*. Both Rafanell's analysis and my own

emphasize the inescapable corporeality of the body and the immeasurable importance of lived, physical experience. However, we also both commit to a communitarian epistemology of the body. Our everyday ability to interact with and understand bodies—including our own—is premised on knowledge and practice. Without classificatory systems and concordant social practices, the ontological constitution of the body would not be possible. Bodies exist as they do because of convention, just as technological artefacts and subjects are intelligible by virtue of their position within specific distributions of knowledge. Being-a-body is a property enabled by categorization.

6.3 Machinic bodies / corporeal chassis

The case material under this section concerns the body in relation to and as an experiential component of motorcycling. It also addresses the role played by technological artefacts in enabling and constraining the ontological constitution, sensorial capabilities, and physical articulations of the body. As material entities, technological artefacts are unavoidably embodied objects, and the corporeal element of technological use is one fundamentally important to the sociological study of artefacts. Not only does embodied interaction play a significant role in our use of technological artefacts, but the physical experience of machinic usage is also a pivotal facet in the ontological constitution of the body in social life. Physical practice and embodied knowledge are both necessary for technological use and constitutive of specific bodies, as I demonstrate below. Here I substantiate one claim: *the physical experience of machinic interaction is centrally involved in the ontological constitution of bodies*. This final section of case material proceeds as did those in Chapters Four and Five, and I similarly demonstrate my above claims regarding the institutional character of bodies. That is, I provide empirical evidence to justify Rafanell's and my argument in favour of a communitarian account of the body. This sociophilosophical argument constitutes the foundation of this chapter, both in isolation and as a component of my broader discussion of entangled ontologies. The argument is necessary as I consider the role that technological artefacts play in the ontological constitution of bodies. Furthermore, it drives my analysis of phenomenological issues concerning sensory experience and the corporeal interaction between bodies, machines, and the world. I note the importance of acknowledging and sociologically accounting for lived physical experience, as well as discussing the influential role played by technological artefacts in enabling and constraining particular modalities of experience.

I begin this section by reviewing the literature on technology, technological artefacts, and the body. I then summarize some key conceptual tools before proceeding with my empirical analysis, which addresses four facets of embodied technological interaction and the ontological constitution of the body. Last, I conclude this chapter with a series of implications.

6.3.1 Studies of technology and the body

Alongside the 'turn' to the body within social and political enquiry came a comparable interest from social studies of technology. Much like broader studies of the body, the literature on technology and the body is a motley constellation of research that has rendered a complex—and often contradictory—portrait of various relationships between bodies and technological knowledge, practices, and artefacts. This work has been accomplished by scholars working across various disciplines and consequently is characterized by epistemological, methodological, and theoretical disparity. Importantly, while those studying technology and the body have made notable analytic and theoretical contributions, a substantial proportion of this work consists of robust empirical investigation. Much has been gained from sophisticated anthropological and sociological studies that document embodied technological practices, just as historical and document-based methodologies have contributed invaluable data in plotting the evolution of technological knowledge and the body.

Here I summarize and discuss a variety of forms that research on technology and the body has taken. Each facet of this research is discussed in relation to the work of one specific author—for instance, in discussing technological discourse and the body I draw upon the work of Nelly Oudshoorn. With this summation I provide the reader with a general overview of the problems addressed by this broad collection of research, the analytic traditions within which these projects were and are being developed, as well as the contributions made by these studies. Finally, I conclude with some observations on gaps in the literature.

As with much of science and technology studies, feminist research has contributed significantly to the study of technology and bodies, from a collection of different—and often contradictory—analytic perspectives, political alignments, and methodological approaches. An early programme in feminist studies of technology—ecofeminism—consistently addressed the relationship between technology as masculine enterprise and nature as

feminine entity as one of violation and disruption (see Merchant, 1980; Easlea, 1987). This tradition—highly sceptical and invariably cynical of technological intervention—was considerably influential in early feminist studies of reproductive technologies. As technological procedures such as in-vitro fertilization and the emergent field of genomics came into being in the 1980s, ecofeminist research responded with critical scholarship on the relationship between technologies and nature. Gena Corea's work on reproductive technologies and the female body (1985 and 1987) directly challenged technological innovation and particularly its insidious ramifications for women and women's bodies. Corea's often-forceful arguments portrayed technology as an oppressive force upon the body; reproductive technologies were characterized as transforming, taming, or rendering obsolete women's bodies. This strand of work on technology and the body thus constituted artefacts as invasive and destructive. I derive from this facet of the literature an understanding of technological knowledge, practices, and artefacts are capable of constraining and disciplining bodies[179], often in manners parallel to broader patterns of social orders.

An alternate grouping of work conceives of technologies not as *constraining* embodied experience and practice, but rather as *enabling* alternative forms of physical practice. Working from the concept of 'affordances' (Costall, 1995), a number of researchers have rendered technological artefacts as enabling mechanisms—both in a textual, meaning-based sense and in a 'real', material sense. In this latter formulation, affordances consist of physical practices provided by, enabled, made easier, or transformed by the use of a particular technological artefact. Dant's work on the relationship between automobiles and drivers (2004) makes use of this concept to articulate the synthetic experience of driving a car. Beginning with the analytic conceptualization of a driver-car assemblage[180], Dant notes the manner in which automobiles transform the physical experience of the driver—not simply in terms of practice, but also with relation to phenomenological considerations. The driver-car assemblage is capable of moving at higher speeds, for longer distances, and in more tenuous terrain than the average human being. Moreover, the experience of driving a car is phenomenologically distinct from that of the pedestrian. This form of analysis is particularly effective when considering the physical and material ramifications of using technology, and is sociologically interesting insofar as artefacts are capable of modifying intersubjective experience by enabling alternative forms of practice. In my own research,

[179] It is possible to re-read much of this literature from a Foucauldian point of view, emphasizing the notion of discipline and 'docile bodies' (1991 [1975]).
[180] Other work on assemblages includes Currier's discussion of Deleuze (2003).

work of affordances has sensitized me to conceptualizing of technology as *productive* of experience and not simply inhibitory of it, particularly in relation to the sensory experience and the body-technology nexus *in physical practice*.

Some of the literature from labour process theory has addressed the question of technology and the body from a perspective very much unlike that of the sociology of technology. Rather than discuss the relationship between technology and the body, authors focusing on manufacturing and the shop floor have studied the body *as a technology* within the wider process of manufacturing and as a physical component of labour politics. The conceptual shift associated with studying the body as a form of technology is an important and fascinating analytic contribution, and while the body is ontologically not equivalent to a technological artefact—*pace* Actor-Network Theory—it can and must be examined as a integral module within technological practices such as manufacturing. Elson and Pearson's study of 'world market factories' in the 'Third World' (1981) contributes—among various arguments put forward—a compelling discussion regarding women's large-scale participation in the manufacturing sector of these countries. The authors undertake to deconstruct the concept of 'nimble fingers'—the notion that Asian women posses naturally adroit fingers capable of efficacious manufacturing. In documenting the disparity between belief and practice in relation to these women's manual dexterity, Elson and Pearson discuss the manner in which executive discourse constructs women's hands as technological mechanisms within the process of manufacturing textiles, electronics, and other mass-produced commodities. The body is a machine with capabilities and specifications that can be quantitatively monitored through its product yield[181]. This conceptualization of the body recasts the place of embodiment in relation to technology in an insightful, provocative manner. Moreover, the two authors contribute an appreciation of training with respect to bodily practices and capabilities which is unequivocally compatible with the Strong Programme. Though not directly influential of my analysis below, this work provides further justification for my claim that bodies are both subjective and objective.

Of particular influence and import to my work has been Ulf Mellström's research on masculinities and technology in Malaysia. Although relevant to this thesis in a number of manners, Mellström's work on subjectivities, embodiment, and technological artefacts is especially relevant to this section. Mellström anthropologically studies the practices of

[181] A similar study of women's physical capacityin relation to technology can be found in Cockburn's study of printing (1999).

automobile and motorcycle mechanics, placing considerable attention upon the function that embodied technological prowess plays in the constitution of particular masculine subjectivities. His research—consisting of countless interviews and hours of observation—substantiates the claim that technological proficiency is a central component of certain subject position. Mellström's study documents the practices of machinic interaction as component of gender performance, whereby masculine subjectivities are constituted as products of embodied skill and male bodies are materialized—to draw on Butler's terminology—as ones concordant with machinery. Machinic embodiment is an act in the acquisition of subject positions; moreover, bodies are categorized in particular ways as a consequence of their interaction with machines. This strand of research has influenced my own work considerably, particularly in developing my ideas of the machine-body nexus and the performative character of embodied practices—in relation to both subjectivities as well as body ontologies. Moreover, his close analysis of subjects and bodies underlies my notion of entangled ontologies, which I explore in detail in Chapter Seven.

Previously, I have addressed the relationship between technological artefacts, embodied skill, and gendered subjectivities, drawing from and expanding upon Mellström's work with mechanics. In recently published work (Schyfter, 2008), I discuss the mechanisms via which embodied interaction with technological artefacts is consonant with participation in specific communities, and the practices of inclusion and sanctioning that govern bodily use of technology. Beginning from Mellström's injunctions concerning collective superordination of embodied machinic skill and drawing from empirical fieldwork with a men's lacrosse squad, my study documents and analyzes the manners in which kinaesthetic skill with technology—in the guise of seamless body-technology interaction—operates as a signifier of and requisite for community participation. This work draws attention to the joint and frequently inseparable kinaesthetic experience—a topic I further discuss below in relation to motorcycling. My study also revealed the normative character of technological use, as well as the role played by convention in influencing, enabling, and constraining body-technology interaction. Normatively appropriate technological practices are pivotal in negotiating community acceptance and membership. From my own contribution to studies of technology and the body, I retain here the importance of the community for individual technological practice, as well as the central role played by sanctioning in the classification and ontological constitution of bodies as 'capable' or 'incapable'.

Oudshoorn's work on various aspects of the development of the male oral contraceptive (2003) presents a unique study within the rubric of technology and the body. Unlike the previous studies, Oudshoorn's work is characterized by methodological diversity and topical heterogeneity. Employing sociological methodology to study the scientific practices involved in and popular response to the development of a male oral contraceptive, a considerable portion of the book addresses the relationship between technology and the discursive body. Oudshoorn is particularly attentive to the manner in which knowledge about a technological artefact can significantly influence social understandings of the body—in this case, media and lay reports of the physiological effects of the 'male pill' dramatically affected conceptions of the virile, masculine body. Oudshoorn's work is a robust, comprehensive examination of the multitudinous relations between scientific discourse and practice, technological knowledge and artefacts, and social conceptions of the body. As such, this definitive study contributes to research on technology and the body in unique and groundbreaking ways. Most importantly here, Oudshoorn's work sensitizes me to the importance of knowledge in the ontological constitution of bodies, as well as the inseparability of technological knowledge and artefacts.

Lastly, I recognize the distinctive contribution of phenomenology to the study of technologies and the body, particularly with relation to the experiential component of technological usage. Merleau-Ponty's *Phenomenology of Perception* (2006 [1945])—and particularly his insights into embodiment, cognition and the experience of artefacts—has sensitized me to various aspects of the body-technology relation. Merleau-Ponty discusses the manner in which artefacts become incorporated within sensorial perception as extensions of and possible improvements to the human body:

> The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight. (Merleau-Ponty, 2006 [1945]: 165)

Here, the artefact becomes a component in the larger sensorial system of touch. Much as I discuss affordances, the walking stick here alters the physical experience of its user; much as I discuss body-technology incorporation, the walking stick is amalgamated into a unit of practice. Merleau-Ponty elaborates upon this latter point:

> When the typist performs the necessary movements on the typewriter, these movements are governed by an intention, but the intention does not posit the keys as

> objective locations. It is literally true that the subject who learns to type incorporates the key-bank space into his bodily space. (Merleau-Ponty, 2006 [1945]: 167)

Technological artefacts—once embedded into and characterized by a series of socially-defined practices—are immanent in corporeal experience. Physical and experiential proximity are of paramount importance when considering technological artefacts, as I discuss in my case material below.

This necessarily swift review of the literature on technology and the body foregrounds a number of broad points for my analysis below. First, technology can function as an enabling as well as a constraining influence upon embodied practices, the shape of corporeality, and expectations surrounding the body. Second, the literature displays the importance of technological artefacts in the acquisition of subjectivities and community membership, both of which are fundamentally important components of this thesis. Third, the research identifies the significance of discourse in relation to and as a function of embodied technological practices. Finally, it is crucial to discuss the phenomenological aspects of technology in the myriad ways in which they appear.

6.3.2 Machines and embodiment

By studying the manners and modalities in which bodies become intelligible, I complement my earlier analyses of artefact ontologies and subjectivities. The case material below substantiates one primary claim: *the physical experience of machinic interaction is centrally involved in the ontological constitution of bodies*. Although this argument has received due attention from a number of authors in the literature on technology and the body, my own work approaches the issue from a different perspective—topically, substantially, and theoretically. In using a Strong Programme analysis—derived from Rafanell's work on the sexed body—my study documents the manner in which technological artefacts are incorporated into the ontological constitution of bodies. Specifically, I focus on technological artefacts as entities immanent in the classification of bodies.

Technological interaction can alter bodies' ontologies. Above, I note the conventional character of bodies—a consequence and fundamental aspect of the body's collective ontological constitution. What we take to be an intelligible body, the manner in which corporeality is classified—even the very shape of bodies—are conventional considerations, and consequently are responsive to localized particularities. The use of technological

artefacts is no less important a contingency than localized beliefs in the ontological constitution of bodies. Technological practice has substantial ramifications upon collective understandings of the body, as well as expectations regarding its proper shape and behaviour.

This section also addresses two secondary claims.

First, corporeal and sensory experience is an important sociological consideration when studying technological artefacts. Throughout this chapter, I emphasize that while bodies are products of social processes and corporeality necessarily underdetermines the body's ontology, the physical, material experience of the body is pivotal to this study. The case material elucidates the importance of corporeality, and further contributes to the broader argument of this thesis by addressing the materiality of subjects and artefacts—a group of topics hitherto elided in this work.

Second, knowledge and practice are *equally important* in the study of technology and the body. The existing literature convincingly demonstrates the significance of both knowledge (e.g. Oudshoorn, 2003) and practice (e.g. Mellström, 2004) in relation to technology and the body, as does Rafanell's work (2003) and relevant research in the philosophy of action (Collins & Kusch, 1998). The empirical data below considers both of these components, paying careful attention to technological practice while at the same time documenting all relevant systems of knowledge and the important links between the two. No study of technology and the body is satisfactorily completed without a discussion of the conceptual frameworks that inform and influence physical practice, or without a robust description of physical practice in its variety of modalities—from a 'purely physical' experience to a performative event.

In discussing, substantiating, and analyzing my primary and secondary claims, I engage with and further elaborate Rafanell's argument. In doing so, my approach to the body—based on the Strong Programme—is advanced. Additionally, by drawing from other literature, including phenomenological work by Merleau-Ponty and Alfred Schutz, I demonstrate the possibility of theoretically reconciling various approaches to the body. Ultimately, the central aim of this section is to substantiate my primary claim and in achieving this goal, evidence the collective character of the body. I do so by focusing on the issue of

classification as it relates to material experience, corporeality, sensory perception, embodied agency, and physical practice—all component of the body in social life.

The case material and my analysis thereof hold potential for various strands of social and political research, extending beyond science and technology studies. Primarily, this work contributes new data and approaches to the study of technology and the body. However, it also contributes to more generalized work in the sociology of the body, and the material focused upon corporeality holds potential for phenomenology. Finally, I emphasize and advance a synthetic approach to knowledge and practice.

The argument contains four modules broadly divided into two overarching themes: corporeality and the body. First, I discuss the physical experience of motorcycling and the material interaction between machines and human corporeality. Second, I address the senses, paying particular attention to the manner in which riding a motorcycle alters the character of sensorial perception—a phenomenological consideration of technological experience. These two arguments constitute my engagement with corporeality. Third, I discuss the notion of the 'limited body' and the manner in which bodily limitations regarding motorcycle use—often derived from age—are practically and discursively incorporated into the ontological constitution of bodies. Last, I address a topic of considerable importance within science and technology studies: the notion of agent-artefact hybridity, both in relation to practice and discourse. This second pair of arguments constitutes my examination of the body. The overarching theme is that of classification, the basis upon which body ontologies come into being.

6.3.3 Corporeal experiences

Alongside the many questions regarding the social aspects of motorcycling, I spoke to the participants often and at length about the physical experience of riding a motorcycle, as well as the importance of this facet of corporeality. Unquestionably, the bodily experience of the motorcycle is neither discrete nor entirely separable from the myriad other considerations within this thesis; to engage in the various social practices I identify earlier is also to ride a motorcycle, an inescapably embodied experience. However, I believe it worthwhile to explore the corporeal aspect of motorcycling as just that—an embodied practice—both so as to render a more comprehensive analysis of the body, as well as to supplement my understanding of artefact ontology with a discussion of machines' materiality. As it concerns

this study, corporeality is present in two modes: first, as a 'purely' physical event, and second, as the material constitution of the body. That is, the corporeal facet of motorcycling is both an event to be lived and experienced—a part of the physical practice of riding a motorcycle—and an element in the makeup of a specific body type—the flesh and bones of the 'motorcyclist body'. Here, I discuss the physical experience of engine vibration, as well as the physicality of scars and other damage to the body. I address these as corporeal phenomena, and illustrate their inevitably conventional character in relation to practices of classification.

The participants characterize the physical experience of riding a motorcycle by referring to a variety of embodied sensations, including—but not limited to—the feeling of wind hitting the face or screaming past the helmet, the smooth pendular motion associated with curvy roads, and the physical exertion of riding through rough mountainous paths. Particularly important in their accounts is the embodied experience of engine vibrations, which manifested itself in the interviews in a variety of guises, from the physical sensation of vibration to the pleasurable sounds of reverberating metal. For my purposes here, I focus upon the feeling of vibration, and the participant's discussion of that embodied experience. For many participants—and particularly those who ride cruisers—the proximity of the engine to the body results in a pleasurable feeling of machinic power. The vibrations of the motorcycle come to represent the sheer pleasure of riding, both through the power to which they allude and the 'purely' physical sensation of the machine. Two participants, both of whom own cruisers, say:

> "… the feeling is very different from riding in a car, right, or on a bicycle, well, because the bicycle doesn't have an engine and you like to have that feeling, logically, of so much, in quotes, power…" (CR-19, female, Honda Shadow 600)

> "… going out on her to ride. Feeling the engine vibrate, because that's what I like most about riding in a group, feeling that vibration…" (CR-23, female, Kymco Hipster 150)

CR-19 and CR-23 both ride cruiser motorcycles—often associated with loud engines and persistent machinic vibration—and both spent much of the interview discussing the physical experience of large motorcycle engines. For CR-19, a fairly shy concert musician and instructor, her Honda Shadow represents a distinct corporeal experience insofar as the vibrating engine is a physical manifestation of the machine's power. The car driver is too separated from the engine to experience such a corporeal sensation, and the lack of an engine in bicycle riding means that this feeling of power is simply inaccessible. For this participant,

the pleasure of controlling a powerful machine is associated with the corporeal experience of mechanical vibration. CR-23 rode cruisers until an accident in which her daughter was hurt forced her to stop riding. Of the things she missed the most, CR-23 noted the feeling of riding with a group. When numerous motorcycles move together closely, or wait at a traffic signal with their engines idling, the noise and feeling of vibration is increased. For CR-23, vibration incorporated more than the individual physical experience. It also was a component of group riding, a corporeal manifestation of community practice.

As such, even corporeal experiences such as engine vibration are contextualized within social practice, and the 'purely' physical is never just physical. Convention affects individuals' appreciation of the lived experience of machinic vibration and as such the pleasure associated with the corporeal is enabled within specific communities and not others. Says CR-01:

> "Well, I love it. The first that, that I love is, well, that it's a big bike, where it's really, you feel the speed, the power to accelerate well, the horsepower, you accelerate that thing and shit, you start to fly, right? I love how soft, I mean, that's very interesting because that varies a lot between motorcyclists, right? You have the people who ride cruisers, right, the Harley-Davidsons. And they like various things. They love for the bike to make a lot of noise and they love for it to vibrate." (CR-01, male, BMW GS 1200)

As a BMW rider, CR-01 appreciates the pleasure of speed and power, but he does not share an affinity for mechanical vibration in the same manner as do those who ride cruisers. He specifically notes the importance of the BMW's soft, though powerful, engine in opposition to those of cruisers, which tend to produce more vibrations and a louder sound. His enjoyment of BMW's sophistication—both technological and symbolic—clearly informs his disdain for machines such as cruisers.

The case of machinic reverberation illustrates a crucial point in the study of the body; namely, that corporeal experience is not self-categorizing. The corporeal experience of vibration is rendered as pleasurable and exciting by reference to convention. Just as corporeality is not self-categorizing, neither is corporeal *experience*:

> It is misleading to say that experiences *have* meaning. Meaning does not lie *in* the experience… (Schutz, 1972 [1932]: 69)

As such, the feeling of mechanical vibration gains its intelligibility as a pleasurable experience—one *expected of and definitive for* cruiser motorcyclists—only in relation to conventional schemata for categorizing experience[182]. What is experienced must be interpreted:

> Interpretation, then, is the referral of the unknown to the known, of that which is apprehended in the glance of attention to the schemes of experience. (Schutz, 1972 [1932]: 84)

Classification thus has consequences for corporeal sensation[183]. The pre-phenomenal, 'pure' sensation of vibration is neither self-evidently a feeling of excitement nor an indicator of machinic power. For cruiser motorcyclists, such experiences are enjoyable. For BMW motorcyclists, this is not the case. Thus, experience is categorized through conventional schemata, and this facet of 'pure' corporeality is intractably linked to collective practice.

A second facet of motorcycling corporeality more directly addresses the material of the body itself. Consistently, the participants noted the aphorism that there exist two kinds of motorcyclists: those who have fallen and those who are going to fall. Accidents—and their physical ramifications—constitute a considerable presence throughout the interviews. The corporeal products of motorcycling accidents—scars, marks, bruises—become physical signifiers for the classification of the body as a 'motorcyclist body'[184], just as certain body parts are constituted as markers of a particular sex. Moreover, these physical attributes are employed discursively as markers of distinction and status. Consider the case of CR-08, who had recently experienced a serious accident while attempting to overtake a line of cars on her motorcycle. She narrated the story of the accident and talked about the corporeal consequences of her fall:

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[182] "The perceiving of the rain, as long as it remains a mere observation, has no connection with the opening of an umbrella. But the perceiving of the rain does cause an Act of attention to the total complex of my past experience..." (Schutz, 1972 [1932]: 93) Similarly, the perception of vibration does not in and of itself *cause* machinic pleasure. The latter is a function of past experience and is contextualized within conventional practices. See also C. Wright Mills, 1940 for the concept of "vocabularies of motive": it is equally possible to speak of collectively-determined 'vocabularies of feeling'.

[183] Note that corporeal experience and pleasure can also be mobilized as indicators of particular bodies: embodied pleasure in the corporeal experience of engine vibration characterizes the cruiser subject and that subject's body, while the inverse is true of BMW subjects and bodies.

[184] Note that the use of scars to classify a body as a 'motorcylist body' lends further credence to a study of age and ageing in relation to technology. The corporeal history of a body becomes an important aspect in its classification; as such, historicity and temporality are of paramount concern in the study of artefacts, subjects, and bodies vis-à-vis social orders.

> "I was driving against traffic, and passed a bunch of cars and the trailer, a trailer that was going there, threw itself and, when I was halfway past the trailer. And when I saw it, it was already on top of me and I hit the bike three times, the handle-bars, against the trailer, I fell underneath and fractured my ankle in three parts, and I was left with a big scar. But I say that it's the tattoo that the bike gave me, and I love it. I love because it's not everyone who has a motorcycle's tattoo." (CR-08, female, unspecified Honda 250)

Although the accident was certainly a negative experience—the motorcycle was effectively destroyed and at the time of the interview CR-08 was still nervous about riding again—the scar produced by the fall came to signify something wholly positive. For this participant, the physical remnant of the accident is not simply a scar, but a signifier of her status as a motorcyclist. Moreover, it functions to vouchsafe her experience and in doing so, renders her body as a 'motorcyclist body'. Her body's ontology is a function of the community's conventional beliefs that accidents are inevitable and operate as rites of passage. Similarly, CR-23—another participant with intimate knowledge of motorcycling accidents—displays her scars and scrapes as signs of experience and as badges of motorcycling honour. Using the same terminology as CR-08—referring to scars as motorcycling tattoos—CR-23 pointed out some of the marks on her arms and hands to me:

> "Motorcyclists' tattoos are falls. You don't have to get them. Don't you see here? All this, all, all of these marks that I have here are scrapes that I've had on the bike…" (CR-23, female, Kymco Hipster 150)

As with CR-08, this participant was deeply affected by her last accident. However, she still displayed her scars as positive markers[185]. Her ebullience regarding the damage done to her skin indicates the manner in which corporeality becomes a signifier for a particular body ontology, that of a motorcyclist[186]. Within the conventional practices of the motorcycling community, scars are semiotic mechanisms[187], and the motorcycling body is one that has experienced damage as a consequence of an accident.

As Rafanell argues, physical markers become capable of signification once embedded within a system of classification. Scars do not speak for themselves; corporeality is not self-categorizing. They come to represent a motorcycling narrative and status for those engaged

[185] Scars were not discussed only by women, despite my choice of representative quotations. CR-08 and CR-23 were simply particularly keen in displaying their marks.
[186] "… the body does not constantly express the modalities of existence in the way that stripes indicate rank, or a house-number a house: the sign here does not only convey its significance, it is filled with it; it is, in a way, what it signifies…" (Merleau-Ponty, 2006 [1945]: 186)
[187] For more on the importance of scars, see Burnett & Holmes, 2001.

in the conventional practices of the community. Not all scars are 'motorcyclist tattoos', and identical marks could help constitute entirely different body ontologies should one fall within and the other outside of the practices of this community. Corporeality does not naturally signify a specific body ontology, as I argue above.

These two facets of the corporeal experience demonstrate the importance of the physical in the sociological study of the body and technological artefacts. The participants consistently noted the corporeal experience of machinic vibrations in their narratives of technological pleasure and the feeling of power brought about when using a motorcycle. Additionally, the corporeal consequences of accidental falls and crashes become signs of a specific body type: the 'motorcyclist body'. In demonstrating the conventional categorization of corporeal experience and materiality, I illustrate that these are critically important in comprehending the ontological constitution of the body in relation to technological artefacts and practices.

6.3.4 Sensorial experience

A second manner in which corporeality appeared throughout the interviews is associated more directly with issues of phenomenology. In addition to discussing the physical, lived experience of riding motorcycles, many of the participants further noted the *sensorial* experience of motorcycling, and particularly the manner in which riding a motorcycle constitutes a substantial difference from driving a car with regard to the senses and contact with the environment. The participants spoke about the superiority of the motorcycle as a machine with which to experience the world, and they placed particular emphasis upon the machine as one that contributed to a holistic appreciation of the natural world—that is, one drawing upon all facets of sensory perception. Additionally, many of the interviews discuss motorcycling as an act of engaging directly with nature by circumventing the isolation of an automobile's cabin. Thus, the participants render an account of the motorcycle as a machine with which to modify the senses and establish an alternative modality of being-in-the-world. Two themes are particularly salient in discussing this topic of corporeality and sensory experience. First, I explore smell as a representative case in the phenomenological relationship between the artefact and the body. Second, I engage more directly with phenomenology and argue that the motorcycle can be understood as enabling new modalities of being-in-the-world, a claim validated by the participants' accounts of their contact with nature. Having done so, I demonstrate the contingency of sensory experience and perception—central facets in the ontological constitution of the body.

To my surprise, sensory experience represented a significant portion of my participants' accounts of embodiment. When discussing the corporeal facets of riding a motorcycle, many of those interviewed evoked the transformation of their sensory space or discussed the manner in which perception is altered during the act of riding the motorcycle. Moreover, my participants frequently used reference to sensorial experience in order to distinguish between the act of driving a car—an experience of isolation and sensorial sterility—and riding a motorcycle—characterized by a cornucopia of sensory experiences and intimate contact with the natural world. The sense of smell was the most discussed and the one most noted as constitutive of the unique motorcycling experience. As such, smell works effectively as an analytic synecdoche for the senses as a whole. The interview participants discussed smell as an integral part of any motorcycling trip; not only is the motorcyclist vulnerable to the elements, he/she is capable of experiencing their diversity:

> "… it's the possibility of being outside against the elements, exposed in a better way, so that, temperatures change and you feel it, smells change from city to forest to beach, all those smells change and you feel it and you live it without anything standing in the middle." (CR-05, male, BMW RT 1200)

> "It's very common to be driving a bike through a neighbourhood and the smells of the food reach you. They're cooking a steak, they're cooking fish. The same happens if you pass next to a woman, you sense the smell of her perfume, because you're totally exposed to everything in the environment. Just the same you get smell, cars' exhaust, you get to hear the noise around you." (CR-09, male, BMW GS Adventure 1200)

As avid users of BMW motorcycles, both CR-05 and CR-09 engage in long-distance travel—a particularly popular form of riding for owners of BMW motorcycles. CR-05 has taken several trips outside of Costa Rica and is planning to lead other ones in the future. Similarly, CR-09 had completed a few years earlier a trip from Costa Rica to Vancouver in British Columbia, and was very eager to discuss the physical and sensorial experience of undertaking such a voyage. Here, both are discussing what they consider a unique property of the motorcycle: the ability to engage with the world directly through the senses. The changes in smell—including those that may be unpleasant—provide the motorcyclist with an ever-changing roster of experiences throughout the trip. Thus the experience of perception becomes integral to the trip itself. Comparably, other participants focused on the unique sensory events of particular locations:

> "The sensation of the environment. I remember, for example, when you ride in Honduras in the country, through the towns, you smell the tortillas, the tortillas and the fried beans. And that's not something you feel in a car, ever." (CR-10, male, Yamaha XT 375)

> "There are wonderful things. For example, like by Cahuita there is a part that at 6:00 in the afternoon at the park there is a, an herb, that like a bush flowers and perfumes the road. Those things when you travel on a bike and that smell, that, on a summer afternoon in Cahuita de Puerto Viejo with the sun hiding there in the west and that smell starts only after 5:00 or 6:00 in the afternoon, that is incredibly wonderful. That's being alive." (CR-26, male, Honda Shadow 500)

CR-10, who currently does not own a motorcycle, discussed the experience of driving through small towns as the element of motorcycling he missed the most. For him, driving through the towns of Honduras—where he used to live—and experiencing the unique smells of each locale's food was a cultural voyage available only through the motorcycle. CR-26 similarly discusses his travel to Cahuita, a national park on Costa Rica's Caribbean coast, as a journey of sensory experience. The unique beauty of the location is available to him because he feels a connection to the environment through smell and by being exposed to the full sensory event. Thus the technological artefact has profound consequences for perception—in this case olfactory—and bodily experience.

A second manner in which the body as phenomenological experience appeared in the interviews revolves around the participants' accounts of a connection with nature. As I note above, participants often distinguished between the experience of the car and that of the motorcycle by noting the vulnerability of the motorcyclist to the elements, and frequently championed the motorcycle as a tool which with to experience and connect with the natural world. The multitude of comments addressing this theme is amenable to an analysis that draws upon Merleau-Ponty's concept of being-in-the-world (2006 [1945]). Although this study is not one in phenomenology, this specific facet of my sociology of technology can be helped by the selective use of certain concepts from the *Phenomenology of Perception*. Temporarily following Merleau-Ponty's claim that being-in-the-world is the basis of not only perception, but all human experience, I can discuss the effects of technological artefacts on the corporeal experience of being-in-the-world. This thesis holds that technological artefacts—and specifically the motorcycle—can enable new modalities of being-in-the-world[188], which my participants account for as the capacity to connect with nature in a

[188] In doing so, I am moving being-in-the-world to a higher order than it was discussed by Merleau-Ponty. Nevertheless, I believe this analytic move is both justified and useful. In many ways, the basic

unique way. Various participants discuss this connection with the environment as a act of 'relating to' or 'being a part of' the environ through which they are travelling:

> "Going out through back roads where there is little traffic and really feeling the same thing you feel always with that bike. It's not so much getting to know the country, I know the country quite well. It's relating to the country through the bike." (CR-10, male, Yamaha XT 375)

> "Being able to connect with nature, when you cross a river on a bike, going through a trail in the middle of the mountain on a bike. It's as if, as if the bike make you part of that nature." (CR-13, male, BMW GS 1150)

Both CR-10 and CR-13 drive motorcycles capable of enduro—or off-road—riding, and consequently their comments address the experience of driving through rough terrain. CR-10, who has yet to drive a motorcycle in Costa Rica, notes that while he is very familiar with the country, he looks forward to connecting with and relating to it through the technology of the motorcycle. Thus the experience of being in, moving through, and sensing the world is altered on the motorcycle, and constitutes a unique modality in the phenomenological experience. CR-13 amends and expands upon this claim by noting that enduro motorcycles enable a connection with nature not possible through other machines, such as sportsbikes. As such, the transformation of being-in-the-world is also contingent upon the particular kind of machinery under examination and in use.

Along comparable lines of argumentation, the distinction between cars and motorcycles was frequently made using phenomenological claims:

> "… the sensation of wind hitting your face, right, of moving from one place to another and having a much wider panorama of what surrounds you [than in a car]. That contact with nature or the environment is what I like the most, really." (CR-27, male, Harley-Davidson Roadking 1338)

> "It's like a feeling, not only of more freedom, but of not being separated from everything, of being isolated. Instead more than anything else… it's a feeling of integration, of being integrated, of being within, I mean, you're in the world, you're connected." (CR-32, female, unspecified scooter)

> "It was the sensation of not having, like in a car, that huge windshield that takes the air away, right? It's a, it's a more intimate contact with everything that surrounds us, from the natural to the smoke and smog that there is on the street, right?" (CR-19, female, Honda Shadow 600)

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phenomenological *condition* of riding a motorcycle is pre-phenomenal and distinct from the *actions* of riding a motorcycle.

These three participants all express the distinction drawn between cars and motorcycles. The major difference between the two technological artefacts, as represented here, is the isolation of the automobile cabin, which the three motorcyclists considered to be disconnected from the entirety of the environment. All three state unambiguously that the motorcycle enables a connection with nature that is not available when driving a car.

These two empirical themes—olfactory perception and the connection with nature—demonstrate the contingency of bodily experience. Perception is a fundamental component of embodiment (see Merleau-Ponty, 2006 [1945]), and is centrally involved in my understanding and conceptualization of the body and bodily experience[189]. Changes to the sensorial capabilities of the body can fundamentally alter the lived experience of embodiment and our classification of the body—the motorcyclist body can be ontologically distinguished as one capable of specific phenomenological experiences[190].

This sub-section addresses the ways that the motorcycle enables a unique sensorial experience[191] and the manner in which artefacts are capable of transforming their users' modality of being-in-the-world. Importantly, the transformation of agents' relationship to the world does not simply help define the character of the machine and the technological experience. The experience is a central component in the ontological constitution of bodies. As Rafanell notes, specific bodies are expected to undertake specific physical practices. I proffer an addendum: specific bodies are expected to undergo specific corporeal experiences, of which perception is a central component.

6.3.5 The limited and limiting body

Body ontologies are social-kind statuses—social institutions—and as such are dependent upon and reflect the particularities of localized knowledge and practices. I suggest that technological artefacts and knowledge are deeply implicated in the ontological constitution of bodies. Here I discuss the notion of the limited or limiting body. When discussing the

[189] Consider our understanding and classification of certain bodies as limited because of perceptual challenges, such as blindness or paralysis.
[190] Bachelard's concept of 'phenomenotechniques' is a compelling way to consider this problem, as it might prove useful in locating the relationship between practice, technology, and the consitution of the 'motorcycling body'. See Bachelard, 1984 [1934] and Rheinberger, 2005.
[191] Clearly, this statement is somewhat of a generalization, though a justified one. Each subject's perceptual capabilities are unique, and engaging with the motorcycle does not make all perceptual experiences identical. Nevertheless, perceptual diversity is a given and accepted condition of the human body, and can be accepted as a fundamental premise here.

physical aspect of riding a motorcycle, the participants frequently referred to their own bodies in justifying or discounting their use of a particular type of motorcycle. Certain practices and artefacts were rendered as acceptable or unacceptable for certain types of bodies, and the result was a particular ontological constitution of the body. Subjects with particular bodies are normatively expected to ride particular motorcycles. Similarly, the body was often discussed as a limiting factor in the choice of machine, compelling the participant to choose a particular type of motorcycle over another. Accounts of limited bodies almost entirely discussed bodily ageing and increasing corporeal limitations (see Tulle, 2008) and as such, fundamentally rely on the ontological constitution of the body as an 'ageing' body. Both of these themes—body as indicative of machine type and body as a limiting factor—substantiate my claim that body ontologies are constituted in relation to technological artefacts by illustrating the relationships between classification, agency, and physical practice.

The classification of bodies into specific types—the selfsame process as the ontological constitution of bodies—influences the expected and normatively acceptable choice of motorcycle to a considerable degree. Certain body types 'go' with certain types of machines. Unquestionably, a considerable factor in this association is corporeality; just as with any technological artefact, there exist physical demands placed upon the user that must be met in order for the machine to be operated successfully[192]. Corporeal properties such as height, arm length, and flexibility are immanent in the choice of one particular motorcycle over another. However, there often exists a preponderance of different corporealities associated with the same model of motorcycle. Moreover, mechanical alterations and accessories can be used to make a motorcycle more compatible with different body shapes. Adjustments to the handle-bars and the seat are not uncommon and can have significant corporeal ramifications, such as changing the angle of a rider's back or the degree to which a motorcyclist has to bend his/her arms. Given this material elasticity, much of the relation between body type and machine type is conventional, and relies heavily upon the ontology of the body type in question. Says CR-01:

> "Depending on your body you have to have a certain type of motorcycle, or there are some that, how do you say, mine is a little tall for people that are not tall… all bikes

[192] In many ways, motorcycling can be characterized as an activity that requires overcoming certain physical limitations. I have here chosen to focus not on the basic corporeal requirements of riding, but instead look at conventional differentiations between various types of motorcycling bodies. I do so in order to document multiplicity in body ontologies and to make connections with my analyses of artefact ontologies and subjectivities.

> have a different position and the type of bike, right, you have sportsbikes, for example, where the pilot is inclined, right? I find that very uncomfortable…" (CR-01, male, BMW GS 1200)

This motorcyclist is describing the association between body types and motorcycles in a fashion that appears to be entirely based upon corporeality and the physical properties of the machine. However, CR-01 goes on to say that the inclined position of sportsbikes need not limit its use by older—and ostensibly less flexible—motorcyclists. Having ridden sportsbikes himself at a younger age, during his twenties, CR-01 argues that much of the riding position adopted on sportsbikes—with a considerable forward incline—is conventional. He argues that forward leaning is simply an affectation, intended to replicate the position of racetrack drivers and whet the motorcyclist's desire for speed. During my research, I tested the riding positions of various machines, and while sportsbikes require more incline than other motorcycles, there does exist a disparity between the position adopted by most riders and the minimum required leaning dictated by the machine's material structure[193]. Thus the requirements placed upon the corporeality of the driver are largely conventional, as is the ontology of a body capable of mounting sportsbikes. Other participants were more explicit in their association of a particular body type with a specific type of motorcycle:

> "Let's say, there are some really big bikes that are for touring, you always see on a touring bike, you're going to see, people that are, well, fat. They choose the bike that fits." (CR-23, female, Kymco Hipster 150)

CR-23's association between considerably overweight riders and large touring machines is another example of the connections drawn between body types—here a 'fat' body—and motorcycle types—here a touring motorcycle. There are in fact few physical impediments preventing 'fat' motorcyclists from using machines such as cruisers or double-purpose motorcycles and empirically I found no correlation between body weight and touring motorcycles. However, CR-23's comment does indicate the normative expectations associated with one particular body ontology. 'Fat' bodies belong on large, slow, comfortable machines. This observation suggests that the ontological constitution of the body is very much implicit in the choice of motorcycle, as societal expectations will invariably influence—although not determine—an agent's decision.

[193] I am here, of course, discounting the conventional processes of design and innovation, which do not consitute central facets of my work. It is helpful to note, however, that motorcycles by no means *require* any one degree of incline by the rider. There is no intractable physical limitation upon this design choice.

These two examples of the association between body type and machine type illustrate the manner in which body ontologies are deployed in justifying a particular choice of motorcycle. The classification of a body enables a particular range of technological choices. As Hacking notes with regard to subjects, and as Rafanell argues with respect to bodies, agency is circumscribed by subjectivities and body ontologies, respectively. In classifying a body—and thus enabling its ontology—certain behaviour—including technological choices—is rendered 'acceptable' or 'unacceptable', 'expected' or 'unexpected'. Concurrently, classification can also be a function of physical practice.

In discussing their choice of a particular motorcycle type, the participants sometimes argued that their bodies prevented them from choosing certain machines or at the very least circumscribed the range of plausible options. Earlier, I examine the manner in which the classification of bodies defines a particular choice of motorcycle. Equally, a motorcycle's physical requisites can come to constitute certain bodies as incapable or limited. The ontological constitution of the body—its classification as a body incapable of operating a particular technology—is thus a function of the motorcycle and the practices associated with its usage. Again, the most frequent discussion of bodily limitations concerned the relationship between 'aged' bodies—which were almost always portrayed as physically inferior to 'younger' bodies—and motorcycles with a 'youthful' ontology, such as sportsbikes. In speaking to their own choice of motorcycle, two participants noted the following:

> "I'm not a person, I don't have, I don't have qualities, let's say, the sport physique. So, a person who is a little, a little stiff, a little rigid, so, I must look like a pole badly put on the bike, right?" (CR-11, male, unspecified BMW)

> "… there are certain bikes that, you have to assume an inclined position, more road bikes than anything else. Some people adapt to those positions better than others." (CR-25, male, BMW GS 1200)

CR-11, a man in his fifties, noted that his motorcycle is somewhat beyond his body insofar as it requires a forward-leaning position. Although his BMW does not require a position identical with those demanded by sportsbikes, he still felt incapable of riding the machine comfortably, despite his great love for it. Because of his incapacity to operate the motorcycle comfortably, he emphasized the ageing of his body, particularly with respect to his lack of flexibility. He also defined his as a body that lacked a 'sport physique', implying that a motorcycle such as the one he owns demands an athletic build. In this sense, it is possible to

identify not only practices of classification, but also norms of embodiment. CR-11 disparages his own body for not conforming to the athletic physique conventionally associated with sportsbikes. In another example of classificatory practices, CR-25—also in his fifties—argued that certain motorcycles require certain body types. Like CR-11, he uses the example of sportsbikes to illustrate the compatibility between certain bodies and certain machines. Bodies that cannot manage to operate sportsbikes are too 'aged', too incapable of the technological requirements. CR-25 further argued that body-machine compatibility extends beyond structure and corporeality to encompass practice as well. He says:

> "Logically there is also the part, the physical aspect of the driver is very important. There are people who have more physical resistance and tire less often, so they can adapt more easily to a bike than others…" (CR-25, male, BMW GS 1200)

The kind of driving associated with particular machines places specific demands upon a rider's corporeality. For instance, riding with a forward incline for long periods of time can be tiring, as can riding in a more upright position through difficult terrain. Each motorcycle's concordant practices place different requirements upon the body. Again, bodies that cannot tolerate a particular machine and its associated practices are constituted as incapable of the physical task—as limiting factors and limited bodies. The artefact can contribute to the ontological constitution of the body both through its structural demands as well as the practical requirements for operating it.

Issues of limited and limiting bodies are issues of classification, whereby particular corporealities are defined and categorized as *not capable* or *insufficient* for specific technological artefacts and physical practices. Recall that body ontologies are invested with particular capabilities and expectation—in this case, sportsbike bodies require the ability to lean in a pronounced manner for extended periods of time. Failure to do so excludes a body from that specific ontology. In all this, it is possible to identify the reticulations between physical practices—what bodies can and should do—and body ontologies—how we categorize and understand our and other bodies.

The ontological constitution of the body as limited or insufficient can be analyzed both with regard to the choice of motorcycle and the manner in which the rider operates the machine. The body's ontology is also mobilized as a justification for, or is constituted as a function of, the agent-artefact relation. In both manners, classification has an observable impact on the body's ontology and its relationship to technology. As an analysis of the limited body, this

sub-section focuses on agent-artefact discordance; by contrast, the following sub-section addresses harmony and concordance between the two.

6.3.6 Hybridity

In addition to noting discord between agents and artefact, the participants of my study discussed the body as a component of harmonious agent-artefact interaction. In this, the body is characterized as inseparable from the machine, the two of which jointly constitute a hybrid entity. The body's ontology is thus 'mechanized'. While the participants' accounts of enjoyable and successful motorcycle riding often drew upon metaphor in order to articulate this claim, the notion of agent-artefact integration was very much a serious one, and is even found in motorcycle riding textbooks (e.g. *Total Control*, Parks, 2003). Here I first discuss general comments on harmonious motorcycle use—these often address the issue of agent-artefact concordance without directly addressing the question of the body. I then use participant comments regarding the unity of body and machine to argue that hybridity is often implicated in the ontological constitution of the body—here, as a 'mechanized' component of the motorcycle. These two themes illustrate that the ontological constitution of bodies is a *process*, learned and maintained through repetition, and that it is often carried out in direct relation to machines.

Agent-artefact concordance is a ubiquitous theme throughout most of the interviews, in notable tension with my discussion of domination and subordination in Chapter Four. The discourse on hybridity ranges from very personal narratives on the conjunction between the machine and the rider's personality, to broad statements about the *need* for hybridity between the motorcycle and its user. What these various articulations of the theme share is an agreement regarding the importance of successful agent-artefact congruency. For some participants, a harmonious connection between the motorcyclist and the artefact is a necessary condition of successful riding, an imperative of this technological practice. They frame the question of hybridity as a *must* in answering questions on the relationship between driver and machine:

> "… there needs to be that harmony between the driver and the machine, right?" (CR-20, male, BMW GS 1200)

> "… when you start to couple, so that, between the bike and you there needs to be like a link that you have to make yourself and until you find it, you'll have a rough time, let me tell you." (CR-30, male, Yamaha YZFR 600)

Both CR-20 and CR-30 discuss the issue of 'harmony' or 'coupling' as a requirement for riding a motorcycle. CR-30, like most sportsbike motorcyclists, places particular emphasis upon the process of 'coupling' with the motorcycle.

Hybridity is also discussed as a more personal experience, with direct reference to emotional and subjective factors. In these cases, the notion of agent-artefact harmony is constituted in broader terms:

> "… the truth is that I think that that bike was, we coupled very well because it was even a small bike and everybody would say, 'but how is it that that bike goes up hills and everything?'… another person would take it and it wouldn't give the same performance that it gave me, right?" (CR-23, female, Kymco Hipster 150)

CR-23, one of the few women to participate in the Coyotes as a driver[194] often felt the need to 'prove herself' as a capable motorcyclist[195]. Much as most women motorcyclists in Costa Rica, CR-23 was under constant scrutiny, and she experienced each successful demonstration of her skills as a major accomplishment within the community. Her motorcycle, a Kymco Hipster 150, presented a mechanical parallel to her struggle. The machine's relatively-small 150 cubic centimetre engine was ostensibly overmatched by the other motorcycles in the community[196]. However, she was able to match the performance of other drivers inspite of this mechanical disparity. For CR-23, hybridity is a consequence of the parallel struggles of rider and motorcycle: the need to demonstrate proficiency and disprove negative expectations.

Lastly, hybridity was articulated as an embodied relationship between the rider and the motorcycle. This physical intimacy is developed through repeated use. In discussing the variety of motorcycles he has ridden, CR-15 said the following:

> "… with the bike you get to form a single being, I mean, the bike, you reach a point and it seems like a lie and that's why people, I don't know if you've heard, for example, you feel the bike, for example I remember that I felt a Yamaha different

[194] Often, women participate as passengers, riding on the pillion. As this thesis is primarily concerned with motorcyclists (drivers), I do not discuss this phenomenon, which is nevertheless an important aspects of motorcycling collectives and practices.
[195] The literature from the sociology of engineering addresses similar concerns, as women often have to prove themselves capable as engineers in manners not expected of their male counterparts (see Faulkner, 2007).
[196] Standard sizes of engines within these communities, measured in displacement, are 500 cubic centimetres or larger.

> from a Honda, different from a Kawasaki, different from a Suzuki…" (CR-15, male, various competitive models)

CR-15 was involved in professional motocross competition until a near-fatal accident prematurely ended his career. After weeks of unconsciousness and months of physical rehabilitation, he was able to resume a normal life—albeit no longer riding motorcycles. During the interview, he recalled his ability to gauge the make and model of a particular motorcycle simply through the physical experience of driving the machine. The embodied relationship formed between the rider and the artefact is such that it differs substantially from one machine to another. The 'single being' he discusses is the product of intimate physical interaction between specific bodies and specific artefacts. This final facet of the hybridity discourse constitutes a useful segway into a discussion of the body in relation to and in unity with the technological artefact.

Although much of the discussion concerning hybridity took the form of a generalized discourse—as I note above—the participants also directly addressed the relationship between the body and the artefact. The various accounts that explicitly discuss the body as a mechanized hybrid focus on the corporeal and emotional experiences of intimate agent-artefact interaction. Building upon the broad discourse of harmonious usage, these participants argued that the body is like a component of the machine, just as the machine becomes almost an extension of the body[197]. Technological practice is embodied practice. Despite the linguistic idiosyncrasies of each interview, one particular term (and metaphor) repeatedly appeared in discussions of close machinic interaction. Often, participants used the notion of 'symbiosis' to characterize the relationship between the user's body and the machine:

> "So there would seem to be a symbiosis there, right? Including when you are driving the bike you feel as if you're part of the bike, it's strange… on the bike you are part of the bike." (CR-03, male, BMW GS 1200)

> "It's simply where there is that symbiosis, that you feel it's part of you… that you're in agreement." (CR-34, male, KTM Adventure 990)

Both participants use the naturalistic concept of symbiosis to qualify their physical relationship to the machine. The linguistic choice is quite specific. Those participants that

[197] I do not advocate an analysis that collapses bodies and artefacts into single cyborgs, hybrids, or assemblages. My discussion here is empirical, and the participants were discussing congruence, not unification.

used the term 'symbiosis' pointed out the mutual dependence between the two entities, suggested an equitable relationship formed through riding. The motorcyclist clearly needs the machine in order to participate in the riding experience; concurrently, the machine cannot move or even stand by itself without its human operator. It is in this union between agent and artefact that the body is ontological constituted as a mechanical component. The discourse on 'symbiosis' is amended by various accounts that discuss the rider and the motorcycle as a 'single piece', physically and practically in unison:

> "… you have to be like a single piece with your motorcycle, you have to feel at ease with her." (CR-36, male, various competitive models)

> "With the bike there was no problem. I loved it and it was like becoming a single piece with the bike. Something very special." (CR-13, male, BMW GS 1150)

These two comments both refer to the body as a mechanical part—a 'piece' of the motorcycle's structure—and the machine as a component of corporeality—a extension or appendage of the body. CR-36, a former driver in speed competition, further characterized the multifaceted unity between bodies and machines. When he was still active as a racer, CR-36 benefited from riding 'factory bikes'—machines constructed specifically and exclusively for a single competitor. These motorcycles, unavailable to the public, are built to the physical specifications of the rider's body. As such, the artefact's structure is tailored to the driver's body, and fits it precisely; put otherwise, the machine is adapted to the driver's body in structure. During competition and through regular exercise regimes, the racer is responsible for physically modifying his riding posture in order to maximize the efficiency of the machine so as to win. During competitions, racers shift their bodies off the motorcycle during turns in order to keep the machine as level as possible—thus maximizing traction—and lower their profile during straight segments of the track—thus reducing aerodynamic drag. Put otherwise, the rider's body must adapt itself to the requirements of the machine in physical practice.

Motorcyclists regard physical harmony with the machine as the ideal condition of riding. In referring to their bodies as components of the machine, and to the machine as a bodily appendage, they develop an understanding of the body as a 'mechanized' entity. Learning to be a motorcyclist incorporates making corporeality compliant to the mechanical requirements of the machine. Just as subjectivity—discussed in Chapter Five—is enabled through learning about and conforming to collective standards, constituting the body's

ontology as a 'motorcyclist body' is a *process* of embodied learning[198]. Such a classification—such a body ontology—has material and practical consequences, as discussed by CR-36 above. Most importantly, it demonstrates that body ontology can be deeply linked to artefact ontology.

Interestingly, narratives of hybridity contradict more pervasive and numerous accounts of domination and subordination. I believe this facet of my participants' accounts suggests three critical ramifications. First is the complexity of technological usage, which often requires many varied forms of physical practice to accomplish different tasks. Turning a corner gently might require more cooperation between machine and rider than quickly avoiding a hole on the tarmac. Second, this tension indicates the multiple discourses responsible for artefact, subject, and body ontologies. As with all social institutions, ontologies overlap and often exist in tension. Most often, the participants characterized the machine as something to be dominated, but in discussing some topics—such as grace in riding or caring for the bike—some accounts privileged harmony over control. Last, this disparity is a common product of qualitative interview research, which can capture the contradictory and idiosyncratic character of social life.

6.3.7 Some implications

This section substantiates one claims: *the physical experience of machinic interaction is centrally involved in the ontological constitution of bodies*. In empirically exploring this claim, I provide case material for Rafanell's use of the Strong Programme in analyzing the body, as well as my own argument concerning the ontological constitution of the body. I drawn attention to the importance of technological artefacts in the ontological constitution of the body, and address the conventional character of corporeality, bodily experience, perception, agency, and physical practice. I discuss the manner in which all of these phenomena are subject to practices of classification that enabled specific body ontologies, and thus technological embodiment is a core component in the categorization—and ontological constitution—of bodies. Doing so redresses the gap in materiality that has characterized my argument so far—Chapters Four and Five did not directly deal with the material and corporeal aspects of artefact and subjects, respectively. This sub-section briefly

[198] Some literature on 'communities of practice' serves as a good introduction to this process. See Wenger, 1998 and Paechter, 2003a, 2003b, and 2006.

recapitulates what has been accomplished and addresses some analytic implications of this work.

Within studies of technology and the body, I contribute a series of important observations. I draw attention to the process of ontological constitution, and discuss the manner in which technological artefacts are implicated in the process of categorization of bodies. Concurrently, I refuse to elide corporeality or reduce the lived experience to simply a discursive one. The physicality of riding a motorcycle—from the engine's mechanical vibrations to the experience of sensing the world—is of considerable importance in the sociology of technology. At the same time, I take direction from previous work on discourse and technology in examining the broad narrative of hybridity, and draw links between discourse—in the form of classification—and practice. Moreover, I build a connection between my work on ageing and subjectivity and the classification of bodies as limiting or limited. The body as an ageing object and as a set of limited experiences forms a substantial part of the empirical data on age and technology, and will eventually come to constitute a significant component of my future work on age and technological artefacts.

As an empirical study of technology and the body, this section also substantiates my secondary claims from above. First, as I note often, corporeality and embodied experience matter. In discussing machinic vibrations and sensorial perception, I address corporeal experience and its relationship to technology. With my arguments regarding scars and being-in-the-world, I substantiate earlier claims that our understanding of embodied experiences are shaped by technological artefacts and practices. Second, I discuss the important relation between knowledge and practice during embodied use of technology and in the ontological constitution of the body. The broad discourse of both hybridity and the ageing body are necessary in the ontological constitution of bodies in the two respective manners—as symbiotic entities and as limiting factors. However, knowledge is not a sufficient condition in order to comprehensively understand the process of ontological constitution. The physical practice of riding is indelibly implicit in enabling and circumscribing particular body ontologies.

This study of technology and the body successfully illustrates the complexity of corporeal and bodily experience, and evidences the social basis of body ontologies—found in the practice of classification. It further contributes to the literature on artefacts and bodies, and

signals the necessity of examining the physical process of technological practice within social studies of technology.

6.4 The institutional body

As Rafanell's work demonstrates and as I argue, bodies are artificial kinds. Drawing from her work on the sexed body and my own empirical and analytic arguments, I establish the applicability and usefulness of a social institutions approach to the question of bodies. In this final review, I recapitulate the major ideas proffered in this chapter. First, I discuss the ontological constitution of bodies as a social process. Second, I consider two problems associated with corporeality through the lens of the Strong Programme's communitarian epistemology.

Bodies—corporealities embedded within social practice—are functions of social interaction. While the material substrate of the body exists independently of society—indeed, the basic physiological requirements of existence must be met by some asocial biological mechanism—it does not exist as the body without conventional knowledge. Our understanding of, interaction with, and experience of bodies are based upon knowledge and practice. As such, the very intelligibility of the body is dependent upon collectives. Taxonomical systems form the basis for our understanding of bodies, and without acts of classification, the ontological constitution of bodies is not possible. Along with the inescapable materiality of the corporeal, this suffices to analyze bodies as artificial kinds.

In deploying a communitarian epistemology to study the body, however, I run the risk of eliding or under-developing the question of corporeality and its corollary problems. The body as a phenomenological entity—a vehicle for interacting with, sensing, and experiencing the world—and as a lived experience require dedicated sociological attention. Though ostensibly an individualistic phenomenon, the corporeal and phenomenological body is yet a communitarian entity. Through a variety of arguments, both Rafanell and I demonstrate that the shape and physical practices associated with bodies are functions of communal conventions. Moreover, I argue that questions of phenomenology ultimately return to the problem of knowledge and convention, both of which are products of collective social practice.

Consequently, I advocate a study of bodies that focuses on collective practices—including the development and application of knowledge—and the manner in which bodies are made intelligible in relation to specific social orders. The study of bodies' ontologies is one that focuses upon intelligibility; the analytic aim is to discern the modalities in which the body becomes enabled as well as the constraints placed upon it. This research emphasis follows from the Strong Programme's communitarian epistemology and from the various traditions of research that have explored the body as a social phenomenon. Bodies are products of collectives, and the categorization of corporeality betrays the epistemic character of differing communities.

Corporeality is undeniable, but it is reference and classification that constrain 'raw' materiality and constitute the intelligible, socially-situated body. Argues Butler:

> To claim that discourse is formative is not to claim that it originates, causes, or exhaustively composes that which it concedes; rather, it is to claim that there is no reference to a pure body which is not at the same time a further formation of that body. In this sense, the linguistic capacity to refer to sexed bodies is not denied, but the very meaning of 'referentiality' is altered. In philosophical terms, the constantive claim is always to some degree performative. (Butler, 1993: 10-11)

Comparably—and necessarily linked with the discursive formation of bodies—is the conventional character of embodied practices. Writes Merleau-Ponty:

> The use a man is to make of his body is transcendent in relation to that body as a mere biological entity. It is no more natural, and no less conventional, to shout in anger or to kiss in love than to call a table 'a table'. Feeling and passional conduct are invented like words. Even those which, like paternity, seem to be part and parcel of the human make-up are in reality institutions. It is impossible to superimpose on man a lower layer of behaviour which one chooses to call 'natural', followed by a manufactured cultural or spiritual world. Everything is both manufactured and natural in man… (Merleau-Ponty, 2006 [1945]: 220)

Bodies and embodied practices are function of knowledge. As such, it is collective practice that makes bodies and bodily practices intelligible. No pure, natural, asocial, and ahistoric body exists.

Moreover, no body exists independently of a subject possessive of it. All body ontologies are inevitably implicated in the constitution of and are themselves functions of subject positions. The relationship between body ontologies and subjectivities is one of great overlap and interdependence. Just as I argue above that artefact ontologies and body ontologies are

constituted from the selfsame social orders that define the 'ageing' body and age-appropriate machines, I demonstrate in Chapter Five that artefacts and subjects are 'aged' in relation to each other. Drawing these two arguments together, it is evident that artefacts, subjects, and bodies are constituted in relation to and dependent upon one another. The properties of being-an-artefact, being-a-subject, and being-a-body are not as dissociable as my chapter structure might suggest. In order to resolve satisfactorily the question concerning ontologies, an integrated approach is necessary—one capable of rendering artefacts, subjects, and bodies as *entangled* social phenomena.

Chapter Seven: Entangled Ontologies

Up to this point, this thesis addresses technological artefacts, subjects, and bodies as discrete problems in the sociology of technology, developing three separate analyses. While I achieve a great deal in doing so, three disjoined arguments do not suffice. The empirical case material constituting the latter halves of Chapters Four, Five, and Six betrays each phenomenon's interconnectedness with and dependency upon the other two, and this thesis holds that a comprehensive understanding of artefacts, subjects, and bodies requires an understanding of them in relation to and as reliant upon each other. This is particularly—though not exclusively—the case when considering social orders, such as gender, sexuality, and age.

Technological artefacts, subjects, and bodies are all amenable to analysis as artificial kinds. This point I argue throughout the previous three chapters, and in each instance I provide empirical case material with a view to demonstrate the usefulness of my sociophilosophical analysis. By employing Martin Kusch's expansion of the Performative Theory of Social Institutions, I render the three as ontologically underdetermined by their materiality and reliant upon collective practices for their existence. Here I draw together the various lines of argumentation and discuss the analytic advantage of studying artefacts, subjects, and bodies as functions of the selfsame social processes. That is, there exists a complete interpositivity in the social processes that constitute artefact ontologies, subject positions, and body ontologies[199].

The first section of this chapter addresses this claim in detail. I explicate my framework of *entangled ontologies* and in doing so, coalesce the various arguments and analyses developed hitherto. Following this, I look to three central concerns for social enquiry, and assess the implications that these have for my study; namely, I consider social order, power, and the relationships between knowledge, physical practice, and the community. Finally, I describe and respond to three possible critiques to my work.

[199] In Foucauldian terms, the discursive formations that govern the constitution of artefacts, subjects, and bodies are one and the same. See Foucault, 1972 [1969] and Kusch, 1991. Using Barnes' rendering of Weberian 'status groups' (1992 and 1995), these ontologies are products of and define the selfsame 'status groups'.

7.1 Artefacts, subjects, bodies

This thesis proffers new applications for the Strong Programme, employing Martin Kusch's notion of artificial kinds in the study of technological artefacts, subjects, and bodies. The three chapters of my argument demonstrate one core claim: that artefacts, subjects, and bodies owe their ontologies to the selfsame social processes. As I discuss sporadically throughout this volume, there is an interpositivity in the manner in which artefacts, subjects, and bodies gain their ontologies and in the rules that govern their intelligibility within social life.

The end result and aim of my earlier arguments is the present development of an analytic lens with which to explore this interpositivity—the notion of entangled ontologies. Proceeding from my parallel analyses of artefacts, subjects, and bodies as artificial kinds, I contend that the ontological constitution of each is indispensably implicated in the other two. That is, artefact ontologies, subject positions, and body ontologies are developed from the selfsame social practices and communities of agents. Consequently, a robust and comprehensive study of artefacts, subjects, and bodies rests upon a symmetrical analysis of the three.

The congruency in form and argument between the various chapters of the thesis is intentional—for functional simplicity and in service of my broader analytic aim. In arguing that artefacts, subjects, and bodies are A-kinds, I present a series of pivotal similarities that unify the three, while concurrently establishing fundamental differences that distinguish them sociologically[200]. Before expounding on entanglement, it is worthwhile to delineate the similarities between artefacts, subjects, and bodies as A-kinds. I do so by examining materiality and underdetermination.

Technological artefacts, subjects, and bodies are all material, spatio-temporal entities. I repeat this ostensibly trivial claim numerous times throughout this thesis intentionally and with substantive reasons to do so. Artefacts, subjects, and bodies are material entities; they must be studied *as such*. The physical structure of a technological artefact—its design, its material logistics, the mechanical experience of operating it, its limitations, and the multitude of physical effects it has upon its user and the environment—are necessary

[200] E.g. subject's self-knowledge or technological function, which are not relevant to all three classes of entities.

elements in examining its character. The influence of materiality upon subjectivity—the importance of physical practice in the articulation of subject positions, the physical experience of intersubjectivity, the role played by corporeal pain and pleasure in the acquisition of subjectivities, and embodied self-knowledge—are some of the many facets of the subject as a physical entity. These are invariably linked with the physical character of the body, which of the three holds the most problematic and complex relationship to materiality. Bodies are material insofar as the very lived experience of embodiment is a physical one; they can be and are modified in physical manners; we experience the world through our sensorial apprehension of it; and any change in their capabilities or makeup is experienced corporeally and reciprocally affects our physical practices and embodied knowledge. Undoubtedly, the character of artefacts', subjects', and bodies' materialities is not identical. We experience the physicality of artefacts through and differently from that of our bodies; the body provides the physicality of the subject and as such the two are not easily dissociable in either practice or analysis; concurrently, our status as subjects fundamentally affects the shape, practice, and experience of our corporeality. As I argue below, entanglement extends beyond ontology. Entanglement also exists in physical practice, and technological interaction cannot be studied without appreciating the entwined character of technological, subjective, and bodily materiality.

Concurrently, recognizing the inescapable and analytically-pivotal character of materiality must not obscure the single most consequential tenet of an A-kind conceptualization: materiality underdetermines ontology. The Strong Programme approach advocated here is centrally concerned with concept application. I am principally attentive to the manners and modalities in which agents classify and understand entities—be those artefacts, subjects, or bodies—and in doing so, constitute their ontologies—the properties of being-an-artefact, being-a-subject, and being-a-body. Classification is a social process and therefore relies upon and influences traditions, precedents, paradigms, and patterns specific to particular communities; it is *not* a process unproblematically determined by the 'natural' or 'purely' physical. Outside social interaction, artefacts *qua* artefacts, as well as subjects and bodies as we are and understand them to be, cease to exist. What remains is material, the individual, or corporeality—'raw' materialities and insufficient conditions for the ontological existence of artefacts, subjects, or bodies, respectively. The contingent and conventional character of these ontologies is at the very core of understanding them as artificial kinds, and follows from their underdetermination by the physical. Needless to state—I address it extensively above—but worthwhile to repeat, underdetermination does not imply either idealism or the

irrelevance of the natural[201]. Importantly for my immediate concerns, underdetermination enables my conceptualization of entangled ontologies.

A consequence of underdetermination is the communitarian character of artefacts, subjects, and bodies—a primary attribute of all artificial kinds. Technological artefacts, subjects, and bodies are collective goods, enabled through, sustained by, and intelligible only within communities of interacting agents. The scope, constitution, and stability of these communities are variable, and collectives rarely avoid overlap with other collectives. For instance—as I discuss in Chapter Four—the motorcycling community writ large subsumes the individual motorcycling groups, just as the community of all Costa Ricans encompasses all collectives of Costa Rican motorcyclists. Artefacts, subjects, and bodies are defined by numerous groups; their ontologies are conventional, multiple, and frequently contradictory. The empirical data represents individuals in formal organizations—motorcycle groups and clubs[202]. However, the collective constitution of artefacts, subjects, and bodies is not a function uniquely attributable to formal organizations such as these. The observations, conclusions, and premises contained herein apply to groups of interacting agents, be they formally organized or not. Artefacts, subjects, and bodies are ubiquitous social phenomena, and the processes I discuss are present in social life as a whole, rather than sequestered in and exclusive to clubs and organizations. Entanglement of artificial kinds requires a broader understanding of collectives.

All three of my foci—artefacts, subjects, and bodies—are artificial kinds. Technological artefacts are A-kinds *par excellence*—Kusch uses several examples of artefacts in introducing the concept of artificial kinds, and my PTSI analysis lends itself most easily to the question of technology. While it is a more complicated matter to demonstrate the analytic character of subjects and bodies as artificial kinds, they are A-kinds nonetheless. The particular difficulties associated with subjects and bodies—for instance, self-knowledge and the phenomenological experience—complicate but do not preclude a PTSI analysis. Having resolved these hindrances, I can demonstrate the core claim of this chapter: that ontologies are entangled phenomena and intelligibility is a function of shared social practices.

[201] I consider this possible critique of my work in 7.4.1.
[202] Methodologically, studying such groups aided in accruing participants and constructing an account of collective practices. Analytically, it served to delineate the analyst's category of 'community', and maximize its congruency with the participant's understanding of his/her 'community'.

7.2 Entangled ontologies

This thesis is primarily concerned with resolving one question: *in what manners and modalities are technological artefacts, subjects, and bodies rendered intelligible?* Put otherwise, I am interested in documenting, analyzing, and explicating the *processes* (manners) of ontological constitution as well as the *character* (modalities) of the resultant ontologies; in doing so, I aim to discern the relationships between social practices and our understanding and experience of artefacts, subjects, and bodies.

My analyses of artefact ontologies, subject positions, and body ontologies methodically demonstrate that these are social institutions enabled and sustained by collective social practice. I convincingly argue that these three's intelligibility as socially-situated entities relies on numerous, varied mechanisms of social interaction. That is, the *manners* in which ontology is constituted are invariably social practices: for technological artefacts, I emphasized the role of reference and use; for subjects, I detailed the constitutive capability of membership and normativity; for bodies, I focused my attention upon classificatory schemata. Although artefacts, subjects, and bodies similarly benefit from all of these processes, the analytic division of labour rendered a comprehensive examination of the processes by which ontologies are constituted.

The empirical case material adjoining and further developing each analytic argument addresses the question of *modalities*. Having proffered a set of theoretical tools with which to understand the process of ontological constitution, I document the character of particular artefact, subject, and body ontologies once these are constituted. Unlike the question of manner, that of modality is more dependent upon and responsive to the particularities of the case material; as such, the division of labour I employ in addressing this second component of my primary research question is substantially different. Rather than examine particular components of one shared process—as with the question of *manner*—I document examples of modality by focusing upon different social orders. In Chapter Four I discuss the phenomenon of heteronormativity in order to explore the modality in which artefacts are ontologically constituted as gendered and sexualized entities. In Chapter Five I focus upon age and ageing to discuss the relationships between masculinities, ageing, and technology vis-à-vis subject positions. Lastly, Chapter Six concerns the ontological classification of embodied phenomena—corporeality, physical experience, perception, and use—in order to address the body in technological practice. These three empirical components constitute

three examples of modality, as well as demonstrations of the relationship between manner and modality. Put otherwise, I use the empirical case material to substantiate my analysis of the processes by which artefacts, subjects, and bodies gain their ontologies, as well as to document sociologically particular requirements for intelligibility—such as the heteronormative imperative.

7.2.1 Ontologies and intelligibility

The preceding review of my primary research question—as well as my approach in developing its resolution—unsubtly betrays this study's overriding concern with ontologies. This is a thesis in questioning ontologies, a sociophilosophical examination of the social practices underlying the properties of being-an-artefact, being-a-subject, and being-a-body. However, its primary research question is one constructed in relation to and focused precisely upon the notion of intelligibility. Consequently, the relationship between ontology and intelligibility must receive comprehensive attention, both as the nucleus of this thesis and as the foundation for this chapter's examination of entanglement.

Both ontology and intelligibility rely upon a single, fundamental premise: that we understand and make sense of artefacts, subjects, and bodies in specific, identifiable ways. Ontology is most directly concerned with these entities' being in social life and our understanding of that being. That is, ontology addresses their statuses as elements of social reality with which we interact and which we constitute as entities through that very interaction. Intelligibility addresses the particularities, limitations, and imperatives associated with these entities' being in social life and our understanding of that being. Put otherwise, the study of intelligibility is the examination of how and why a specific being is valid and others are not so[203].

These two problems are fundamentally related. In studying the manner in which ontology is constituted, researchers are compelled to examine why and how an artefact's, subject's, or body's ontology is intelligible as it is and not in another way. It is the processes by which this understanding is constituted and the modalities it assumes in social life that are the core interests of this thesis.

[203] Put yet another way: ontology is the property being-an-artefact (or subject or body); intelligibility represents the demands we make and the constraints we place on the character of that property.

Conventional beliefs, standards, norms, patterns, traditions, and precedents—all elements of collective practice—form the basis upon which intelligibility operates. Consequently, localized communal practices further constitute the basis upon which ontology and intelligibility are linked. If intelligibility enables and delimits ontology, and intelligibility is a function of convention, then the relationship between ontology and intelligibility is dependent upon and uniquely characterized by intersubjective practice. Consider the heteronormative imperative discussed in Chapter Four: conventional beliefs regarding gender and sexuality delimit a particular intelligibility for the motorcycle, and its ontology is constituted correspondingly.

With regard to the present discussion, ontological constitution and intelligibility—as functions of collective practices—are interlinked phenomena. As I now argue, the intelligibility and ontological statuses of artefacts, subjects, and bodies are necessarily related to and dependent upon one another.

7.2.2 Ontology and manner

I explore the constitution of three ontologies—those of artefacts, subjects, and bodies—singularly. However, ontology is not a fragmented phenomenon. Artefact ontologies, subject positions, and body ontologies are *entangled*. The ontological constitution of artefacts, subject, and bodies proceeds from common practices and knowledge; artefacts, subjects, and bodies gain their ontology in relation to and dependent upon one another; and intelligibility affects all three in a uniform fashion.

Recall that PTSI's overriding concern is that of concept application and classification. In ontologically constituting an artefact, subject, or body, we are classifying the entity collectively in a particular fashion, according to particular conventions, with specific and consequential normative implications. Importantly, finitism—discussed in Chapters Three and Four—implies that no concept is an isolated phenomenon. Our understanding, use, and normative sanctioning of any one concept is dependent upon and influences myriad other concepts, which are themselves further linked with other concepts, and so forth. Barnes writes:

> Atomistic theories of concept application (and hence of 'meaning'), which consider solely the relationship between a single isolated concept and that to which it applies,

> are inadequate. Delocalized accounts, which deal with connected sets of concepts as organized wholes, are required. (Barnes, 1981a: 30)

We cannot classify one entity without capably understanding its relationship to other entities. While Barnes was primarily discussing similarity and difference relationships—that is, our ability to classify one entity demands a capacity to differentiate between numerous entities—this tenet of finitism underlies another sociophilosophical claim: that ontologies are entangled.

Consider the conceptual relationships that exist between artefacts, subjects, and bodies in motorcycling. The ability to distinguish between various styles of motorcycles is a requisite for agents' successful classification of one artefact as a cruiser and another as an enduro motorcycle. We require a comprehension of various concepts to understand and to use successfully one concept. Similarly, we require a cache of interrelated concepts in order to classify different subjects and different bodies. However, this principle of finitism is farther-reaching. Conceptual dependence occurs not simply within each broad class—artefacts, subjects, and bodies—but also between them.

Such reliance is evidenced by my above study of age and ageing in motorcycling. At the most basic level, our understanding and classification of an individual as a particular type of motorcyclist—say, a Harley-Davidson (H-D) motorcyclist—is reliant upon our understanding and classification of the technological artefact as a Harley-Davidson. Similarly, our classification of that subject's body is dependent upon our classification of the subject as a H-D motorcyclist and the machine as a H-D. We require this conceptual dependence to make sense fully of our acts of classification, and this interwoven process betrays the more complex (and consequential) character of entanglement.

Recall my discussion of the 'aged' machine. A Harley-Davidson Roadking 1338, such as that driven by CR-27, is a large, lumbering, but stylistically-elegant artefact. Unlike sportsbikes (say, the Yamaha YZFR 600 driven by CR-30), this machine does not exude speed or 'sexiness', but rather tradition and tempered power. My participants categorized it as a machine fitting for older motorcyclists, in their late 40s or older, and not for younger drivers. Thus, the ageing of the motorcycle is dependent upon the ageing of the subject, both of which are categorized as older and more 'gentlemanly'. Similarly, the body of the driver is one that need not exert itself too greatly, as it might do in riding a sportsbike or an enduro

motorcycle. Understanding the machine's ontology demands understanding those subjectivities associated with the artefact and the bodies employed in operating it.

The relational character of concepts demonstrates that establishing and using specific concepts is a subset of a larger process: that of establishing and using constellations of concepts. Just as we need to comprehend and be adept with the notion of a feather in order to understand what constitutes a duck, so we need to understand a duck's relationship to geese and swans. Additionally, a full understanding of this animal requires an appreciation of its environment, its behaviour, and its relationship to human society. Thus the ontology of a duck is invariably linked to our knowledge concerning ponds, flying, and duck *à l'orange*. These are substantially different concepts, but are necessarily interlinked and constituted in dependence with one another. The ontological constitution of artefacts, subjects, and bodies operates in such an interactive manner. Entanglement implies that in constituting the ontology of a motorcycle, its user, and that user's body, the community is in fact bringing into existence a constellation of mutually-dependent ontologies. Evidence for this claim is found in the character of sportsbikes, 'young' motorcyclists, and racing practices.

The Yamaha YZFR 600 sportsbike gains its ontology in relation to 'youthful', thrill-seeking motorcyclists. These subjects display certain conventional characteristics, and their communally-constituted subjectivities reflect concepts of speed, driving precision, and the rush of adrenaline. Their bodies are ontologically constituted as youthful by reference to the contortions of the driving position and group-specific physical practices. Gaining distinction within sportsbike groups, such as Tico Superbikes, often derives from embodied displays of technological proficiency (see also Schyfter, 2008). Touching one's knee to the ground during tight curves is particularly indicative of embodied technological skill. At the same time, technological knowledge—such as expertise with motorcycling information or maintenance—helps define a sportsbike motorcyclist with distinction. The ontology of the machine, the driver, and that driver's body are linked to each other and to physical practices and knowledge. The constellation of concepts implicated in the ontologies of artefact, subject, and body extends to the act of touching one's knee to the ground and the knowledge of how to maximize an engine's performance.

Moreover, normativity is relational. Throughout this work, I note that sanctioning upholds collective norms and corrects deviance from the communal consensus. Entanglement implies that communal normative standards concerning artefacts, subjects, and bodies are not

isolated from one another. The knowledge required to correctly use a motorcycle—the set of knowledge and physical practices needed to ride the machine—is implicit in the ontological constitution of the artefact, is demanded of those who would occupy the subject position of a motorcyclist, and is fundamentally embodied. Moreover, as ontology is conventional, artefacts, subjects, and bodies are held accountable to common normative expectations, originating from one common source: the community.

Recall the notion of age-bound acceptability. The participants stated that some machines 'make sense' for some ages, while others do not. An older motorcyclist, in his/her 40s or 50s, is generally dissuaded from using sportsbikes, while such pressure does not exist for cruisers or double-purpose motorcycles. The latter are machines for subjects who 'feel their age'. Subjects in mid-life who conform to social orders of age attain normatively-acceptable subject positions and drive artefacts with corresponding ontologies. As I discuss at length above, their body ontologies similarly undergo a normative process by which they are constituted as appropriate for cruisers, but limited and limiting for sportsbikes. These normative evaluations of artefacts, subjects, and bodies arise from a common point: the social order of age.

The indissociable character of artefact, subject, and body ontologies is a function of their common origin in communities of agents. The three share a common heritage in the traditions, precedents, paradigms, expectations, and practices of the community. Artefacts, subjects, and bodies are *not* ontologically identical—there exist substantial differences—but they *do* share a common social foundation, within and through which the analyst is compelled to study and explicate them. Artefacts, subjects, and bodies are entangled insofar as the three are produced within the same collectives. The same agents constitute them; changes to the collective affect all three of them; they are functions of the same knowledge and practice; and correspondingly, they are enabled and constrained in similar modalities.

7.2.3 Intelligibility and modality

Just as the *manner* in which artefacts, subjects, and bodies become intelligible—the process of ontological constitution—is characterized by entanglement, so too are these entities' ontological *modalities*. Intelligibility is relational and jointly contingent.

As I discuss above, one of the primary links between ontology and intelligibility is that of the community. Intersubjective practices, localized to specific collectives, constitute the set of traditions, precedents, paradigms, and expectations responsible for validating and invalidating particular ontologies. What a community considers intelligible is a function of shared knowledge and practices. As ontologies are entangled by virtue of their common origin within specific collectives, they are susceptible to the same traditions and beliefs that characterize those communities. Artefacts, subjects, and bodies are products of communities of agents who, by definition, share a collective history, practice common acts, display consensual knowledge, and strive to conform to communal imperatives.

The valuation of heterosexuality—discussed in Chapter Four—is a social order found in Costa Rica, and its ramification affect the motorcycling communities I studied. The heteronormative imperative in the classification of genders, sexualities, and desires is implicated in the ontological constitution of artefacts, subjects, and bodies. Artefacts are ontologically constituted as passive, heterosexual, and feminine. Similarly, heteronormativity influences the constitution of subject positions; subjects are expected to behave in particular manners and conform to specific sets of practices. Finally, bodies are categorized according to patterns of gendering and sexualization. These ontologies arise from a common point: the series of traditions and imperatives—sustained by the community—that superordinate heterosexuality at the expense of homosexuality. Intelligible artefacts, subjects, and bodies are enabled and delimited by the community according to the selfsame series of conventions. Intelligibility is entangled insofar as the three ontologies are constituted according to the same system of rules and expectations.

Additionally, intelligibility is a relational phenomenon. Not only do artefacts, subjects, and bodies display a common ontological heritage and a shared set of constitutive requirements, they are intelligible in relation to one another as well. That is, collective determination of valid and appropriate artefact ontologies is invariably linked to that collective's understanding of intelligible subject positions and body ontologies. Without a concordance between the three, the ontological constitution of one fails to operate successfully.

Consider the heteronormative ontology of the motorcycle. I argue in Chapter Four that this specific modality of artefact ontology is one defined by rules of formation corresponding to the heterosexual matrix. That is, the intelligibility of the machine is predicated on a distribution of knowledge and classificatory schema characterized by the valuation of

heterosexuality. The artefact is ontologically constituted as a feminine, heterosexual entity. My argument also stresses that this ontology is the product of collective interpretation of the agent-artefact relationship, of which the machine is but one component. For the artefact to be constituted as a partner in a domination/submission relation, a second element is necessary. The machine as feminine is intelligible only insofar as the rider is masculine. The intelligibility of the masculine, dominating subject depends upon and makes possible the intelligibility of the artefact as correspondingly feminine and subordinate. As much of this relationship is articulated physically, the body is similarly immanent to the intelligibility question. The relational character of intelligibility is further indication that ontologies are indissociable, as the rules for their formation cannot be understood as operating independently.

7.2.4 Practice and materiality

Practice and materiality are also entangled phenomena. By drawing attention to these, it is possible to detail the pivotal character of physical practice in the ontological constitution of artefacts, subjects, and bodies, as well as its susceptibility to the constraints of intelligibility; by studying material entanglement, I can develop further my work on the material and corporeal, and extend some of Chapter Six's observations into wider analytic conclusions. Considered broadly, the study of practice and materiality as implicit in entanglement is both necessary—the physical cannot be elided—and productive—the analyst gains a more comprehensive understanding of the problem.

Throughout this thesis, I repeatedly identify physical practice as a core component of ontological constitution and collectivity. The ontological constitution of technological artefacts is dependent upon their usage in specific manners; usage is technological physical practice, a conventional set of acts. Similarly, physical practices are associated with acquiring subject positions—for instance, those that articulate a proficiency with artefacts and those that signify competence with the conventional expectations of particular collectives. Lastly, I dedicate considerable attention to the relationship between corporeality, physical practice, and the ontological constitution of the body. Here I supplant these discussion with an analysis of the entangled character of conventional physical practices.

Consider the physical practices associated with riding a sportsbike. Conventionally, sportsbike motorcyclists within Tico Superbikes ride their motorcycles in a manner that

replicates the forward-leaning postures adopted by professional racetrack motorcyclists. They press their torsos onto the motorcycle's tank, lower their elbows, and lean their heads close to the windshield. These physical practices serve to decrease wind resistance in professional racing; in amateur riding, their function is affective and their preponderance is limited to particular communities. It is empirically accurate to state that this physical practice is associated with a specific group of motorcyclists. Like all technological physical practices, this one is formative—it is constitutive of and guided by a community and its conventions (Collins & Kusch, 1998). In adopting this posture, agents in TicoSuperbikes ontologically constitute their machines as fast, aggressive artefacts by emulating racers in the professional circuit. They gain a particular subjectivity insofar as their physical practices signify a desire for speed and proficiency with dangerous driving. Finally, they constitute their bodies as capable and youthful, as the contortionism required to achieve the position is repeatedly derided by older drivers as uncomfortable and the remit of youthful bodies. In this sense, the physical practices that underlie artefact, subject, and body ontologies are productive of all three, and correspond to the community, rather than one part of the triad.

Similar entanglement is present with relation to materiality itself. Our understanding of an artefact's materiality is informed by our understanding of the subject's physicality and the body's corporeality. Our experience of and knowledge concerning these three are linked in myriad ways, which must be addressed and appreciated in sociological studies of technological artefacts—inevitably, such research ultimately concerns physical, lived practices.

The first, most conspicuous facet of entanglement is that of the subject-body relationship[204]. Clearly, the physicality of the subject is the corporeality of the body; the two are experientially and analytically indistinguishable. To state that a subject exists physically is to note that the subject's body exists in space and time. My distinction is an analytic move, intended to help me examine the process of ontological constitution; nevertheless, full dissociation is impossible. Particular subject positions are enabled by or denied to individuals possessive of particular corporealities, just as corporeality—while not determinative of body ontology—significantly influences communal acts of classification as well as physical practice. As such, the ontological constitution of the subject is deeply

[204] I am neither stating nor advocating here a Cartesian interpretation of the subject-body relationship. My distinction is an analytic tool. I subscribe to a position closer to that of Merleau-Ponty (2006 [1945]), insofar as I do not believe that body and mind are distinct *experientially*.

entangled with the ontological constitution of the body through their shared materiality and experience.

Material entanglement is also found in relation to technological artefacts. I discuss the ontological relationship between artefacts and bodies in Chapter Six, but other facets of entanglement remain. Most obviously, the physical make-up of artefacts significantly influences our embodied experience of operating them; this corporeal experience in turn is implicit in the ontological constitution of the body. Just as with any technological artefact, the motorcycle requires precise corporeal movements for its operation. Fingers, wrists, and ankles must be trained in order to control the various aspects of the machine and its engine. The specific configuration of the controls—the location of the brakes, the gear shift, and so forth—and the particularities of these mechanisms—for instance, the 'stiffness' of the clutch—are unique to every motorcycle. Consequently, the body must be physically configured to the particular materiality of each artefact. In doing so, and in being able to perform these physical practices competently, corporeality gains skill; the body becomes ontologically classified as proficient in its physical practices, and the subject gains new qualities in relation to his/her subjectivity. The materiality of the artefact—physically experienced and ontologically constituted in specific manners—is unavoidably linked to the body's participation in the ride. The two ontologies are entangled, and as the agent-artefact relationship changes through training, so the character of this entanglement evolves.

7.2.5 Symmetry

Underlying this thesis' analysis, its congruent chapter structures, and the present argument concerning entanglement, is an important methodological and theoretical implication: that the ontological constitution of technological artefacts, subjects, and bodies should be examined symmetrically as social processes. This extension and re-imagining of the Strong Programme's symmetry principle is at the heart of my sociology of technology, one that looks at technology as an invariably social phenomenon, while at the same time avoiding a universalizing account of social life as an actor-network[205]. As I discuss here, my notion of symmetry relates to methodology and analysis, rather than metaphysics. There exist substantial and crucial differences between artefacts, subjects, and bodies—I identify and explore these above. My aim is not to develop a universal understanding of the three as

[205] Actor-Network Theory's concept of 'generalized symmetry' is discussed later in this sub-section, and in 7.4.3.

identical entities, but rather to propose an approach to studying their situated existence as components of social life.

Artefact, subject, and body ontologies are collective goods; they are social phenomena. Our interaction with and experience and understanding of artefacts, subjects, and bodies are contingent upon their being socially-situated. Without artefact ontologies, technological artefacts would not exist as they do; this is as much to say that artefacts *qua* artefacts are reliant upon the social practices to bring them into existence. The same is true of subjects and bodies. As I demonstrate above, artefacts, subjects, and bodies display a common heritage in the form of communities and conventions. It is not possible to dissociate the ontological constitution of one from the other two; the root processes responsible for these ontologies are shared. This set of arguments constitutes the basis for a re-imagining of symmetry and its methodological implications.

As entangled social phenomena, artefact, subjects, and bodies must be contextualized within and understood in reference to the productive practices of interacting agents. The community is the measure. It is by examining the collective, its conventions, its sanctioning practices, its physical practices, its material constitution, that artefacts, subjects, and bodies can be fully understood and their ontological modalities explicated. To understand the community is to understand the manner in which ontologies are constituted and the modalities in which artefacts, subjects, and bodies exist. The three share a common unit of analysis.

Entanglement implies that the productive practices of the community are deeply and intricately interlinked. Exploring a community's normative standards and expectations for technological artefacts, for instance, is also studying normativity as it relates to subjects and bodies. Moreover, changes in artefact ontology are necessarily complemented by changes in subject and body ontologies, requiring a comprehensive—rather than a discrete—approach. This is the fundamental ramification of entanglement: the methodological and analytic impossibility of entirely distinguishing between the ontological constitution of artefacts, subjects, and bodies. Studying one implies and makes possible studying the other two.

Symmetrical analysis is the defining characteristic of my proposed approach to the social study of technology[206]. A systematic and consistent application of PTSI to the question of

[206] My use of symmetry is not that of SCOT (Pinch & Bijker, 1984), which examines success and failure in technological *design*.

technology—alongside subjects and bodies—underlies a robust sociological exploration of technology as a component of social life, and as a class of entities that exists only within and through intersubjective practices. Technology should not be studied or analyzed as distinct from, influenced or transformed by, or in a mutual-shaping relationship with, society. To do so necessarily implies a distinction between social life and technological artefacts, while in practice no such division exists. Technology is *part, parcel, and product* of society and social life, and must be understood, studied, and explicated as such. That is, technology must be studied as other social practices and institutions are studied. The use of social theory must be symmetrical.

Importantly, this imperative to analytic symmetry is not identical to or a validation of Bruno Latour's generalized symmetry (1999b). Latour's reconstitution of the Edinburgh School's symmetry principle aims to develop a comprehensive analysis of nature and society, treating both equally and giving to all elements of a now-singular class agentic status. I further engage with Latour's argument below; for the time being, it suffices to note that my symmetrical analysis follows the tenets of the Strong Programme, rather than those of Actor-Network Theory.

The original symmetry postulate—one of four tenets of the Strong Programme in the sociology of scientific knowledge—concerns the relationship between 'true' and 'false' knowledge claims (Bloor, 1991 [1976]). As I note in Chapter Three, symmetry requires the sociologist of scientific knowledge to employ "the same types of causes" (Bloor, 1991 [1976]: 7) in explaining the development of 'true' and 'false' beliefs about a particular phenomenon. The 'inherent truth' of a scientific fact cannot be counterpoised against negative social 'static' in justifying the prevalence of scientific truth over 'incorrect' beliefs. The development of a scientific fact and the rejection of alternative explanations must be discussed using the same social causal argument.

My use of symmetry extends and re-imagines the postulate within the sphere of social theory and the sociology of technology. My use of PTSI engages with artefacts, subjects, and bodies as analytically-similar entities. As such, my use of symmetry concerns the sociologist's understanding of technological artefacts, subjects, and bodies are functions of collective social practice. Correspondingly, a symmetrical analysis seeks to employ the same form of analysis and identify the common social practices that enable the ontological constitution of artefacts, subjects, and bodies. Symmetry in this case aims to treat these three

as components of social life, rather than distinct and disjointed entities with incidental links to one another and varying connections to collective practice. Entanglement and social theory demand analytic symmetry.

7.3 Some sociological considerations

Having discussed the notion of entangled ontologies, its relationship to intelligibility, materiality, and methodological and analytic symmetry, I now address some sociological considerations of paramount importance. This section discusses social orders, power, and the relationships between knowledge, physical practice, and the community.

7.3.1 Ontologies, intelligibility, and social orders

Much work in the sociology of scientific knowledge concerns the relationship between knowledge and the social order (e.g. Shapin & Schaffer, 1989); similarly, innumerable studies of technology have considered the relationship between artefacts and the social order (e.g. Winner, 1980). As a study that straddles both disciplines, this thesis is deeply concerned with technological artefacts, knowledge, and social orders.

I begin this consideration of social orders with a look back unto the question of intelligibility as I address it analytically and empirically. Recall that intelligibility constitutes the rules of formation—the criteria for enablement and delimitation—for artefact, subject, and body ontologies. Furthermore, my case material from Chapters Four, Five, and Six demonstrates that different social orders distinctly influence the manner in which artefacts, subjects, and bodies become intelligible. These two considerations guide me toward a first observation concerning social order and intelligibility—namely, that the practice of enabling and constraining particular ontologies as intelligible or unintelligible, reflects multitudinous and overlapping social orders. Consequently, intelligibility is a proxy with which to analytically gauge the social orders of a particular community. Barnes argues that society should be understood as a distribution of knowledge within which normative orders exist (1988). Moreover, Bloor argues that classificatory activity is a manifestation of a community's social orders (1982)[207].

[207] "In 1903 Emile Durkheim and Marcel Mauss formulated one of the central propositions of the sociology of knowledge. They said that the classification of things reproduces the classification of men." (Bloor, 1982: 267)

Consider my study of gender, sexuality, and artefacts in Chapter Four. The heterosexual matrix is a distribution of knowledge that delimits and enables processes of classification. Much as Barnes argues regarding knowledge writ large, our classificatory activity (for artefacts *and* subjects *and* bodies) is guided by a heteronormative imperative. Unique ontological constraints—specific rules of intelligibility—are guided by specific components of the distribution of knowledge. Social orders are thus manifest in intelligibility.

The relationship between order and intelligibility is also evident with respect to normativity. Recall that intelligibility delimits the validity of ontologies, and thus is closely allied to processes of sanctioning and correction. Similarly, social orders are fundamentally normative orders, and it is the corrective practices of agents—sanctioning—that are constitutive of these orders. As such, the study of social orders in relation to artefacts, subjects, and bodies is the study of intelligibility and the constitutive capability of normativity. Barnes, in discussing sanctioning, argues that acts of correction constitute a fundamental component of all social life:

> Life is ongoing interaction and mutual sanctioning. It is a process that generates and sustains agreement in cognition through our intense susceptibility to each other in ongoing interaction. It is a process that moves us in the direction of a shared conception of what there is and what there ought to be (with the 'is' and the 'ought' not necessarily set apart or differentiated in that conception). (Barnes, 1988: 138)

Through sanctioning, classificatory activity—the basis and practice of ontological constitution—becomes concerted behaviour. Correspondingly, the ontological constitution of artefacts, subjects, and bodies is dependent upon the corrective practices of interacting agents. Not only is intelligibility a proxy with which to understand and analyze social orders, but the practices that maintain the dominance and prevalence of these rules of formation are those that sustain social orders as well.

This consideration of intelligibility, social orders, and the ontological constitution of artefacts, subjects, and bodies contributes several keys insights. First is a further validation of the notion that classification follows and sustains social orders. Second is additional evidence for entangled ontologies, insofar as our classification of artefacts, subjects, and bodies is a function of and an integral component in a variety of shared social orders[208]. The three inevitably follow the selfsame social orders. Third is the importance of mutual-

[208] Consider that ontologies are performative insofar as particular modalities bring into existence specific relationships to the social order (responsibilities, expectations, etc.).

susceptibility and normativity as key elements in the constitution of ontologies, and as necessary phenomena for the existence of rules of formation—intelligibility requirements.

7.3.2 Power

This rendering of social life—mutual susceptibility and continuous sanctioning—misses a key social consideration: power. Social life is not flat; all agents are not the same; power differentials exist[209]. As a study dealing in substantial measure with social orders, this thesis must account for the heterogeneous character of communities with regard to power, agency, and mutual-susceptibility. Much as Foucault (1982) and Barnes (1988), I here identify *social power* as the capability to govern others by controlling the field of possible practice:

> [Power] is a total structure of actions brought to bear upon possible actions; it incites, it induces, it seduces, it makes easier or more difficult; in the extreme it constrains or forbids absolutely; it is nevertheless always a way of acting upon an acting subject or acting subjects by virtue of their acting or being capable of action. A set of actions upon other actions. (Foucault, 1982: 789)

This form of government[210] extends beyond agency in physical practice to incorporate the realm of ontological intelligibility. Power can be 'measured' by an agent's ability to modify the social orders underlying the intelligibility of artefacts, subjects, and bodies. The ability to transform patterns and distributions of knowledge constitutes the very core of social power:

> Social power *is* the capacity for action in a society, and hence is predominantly but not wholly identifiable as that which is routinely possible therein. Social power is *possessed* by those with discretion in the direction of social action, and hence predominantly by those with discretion in the use of routines. (Barnes, 1988: 58, emphasis original)

This definition of social power has particularly important ramification for my analysis and argument hitherto. If the capacity to transform distributions of knowledge constitutes the foundation of social power—and knowledge is the fundamental basis upon which intelligibility, ontological constitution, and social orders operate—then social power is manifest in the very manners and modalities in which artefacts, subjects, and bodies are ontologically constituted. Moreover, as these three classes of entities are entangled phenomena, then social power manifests itself holistically—though not necessarily in a consistent or even manner—across the triad.

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[209] "All animals are equal, but some animals are more equal that others." (Orwell, 1996 [1946]: 133)
[210] See Foucault, 1982, for his analysis of the term 'government' in its expansive sense.

Importantly, power is linked to mutual susceptibility and sanctioning. As I note during my various arguments above, mutual susceptibility is not a homogeneous condition of interacting agents. While all agents in a community must possess a 'basic quality' of receptiveness to intersubjectivity, agents differ in their capacity to influence, enable, or constrain the behaviour of others. Stated simplistically, agents with greater capability to wield power have greater potential to affect the behaviour of other members of the community. Comparably, while all agents are subject to sanctioning, normativity is not socially 'flat'. Authority differential are ubiquitous[211]. Again, those invested with authority—those capable of exercising power—are more able to sanction fellow community members. Moreover, individual acts of sanctioning carry different grades of effectiveness depending on which agent is carrying out the correction. Mechanisms of self-correction respond in differing ways to sanctioning by agents possessed of authority and by those who are not.

In my conceptualization of ontologies, such properties of power are linked to subject positions. As such, while particular subjects may possess greater power and authority and less susceptibility to other subjects, these qualities are enabled by the community in concert. Authority is a social-kind status attributed by and existent only by virtue of collective practice. While the consequences of power differential are 'real', power itself is no more static or unquestionable than are subject positions. Thus, a complex dialectic exists. Communities enable power through particular distributions of knowledge. However, that power exceeds the knowledge that brings it into existence, and is capable of modifying the distribution of knowledge and community of which it is a function[212].

An additional consequence of this conceptualization of power is its relationship to self-knowledge and self-regulation. As I note in Chapter Five, self-knowledge is amenable to a communitarian epistemology. Importantly, Foucault's discussion of 'practices of the self' (1990 [1984]) elucidates the ramifications of disciplinary power for the single subject. In self-understanding and self-regulation—critical components of my analysis of subjects and bodies—power is (again) a heterogeneous phenomenon. While certain social orders affect all agents in a (nearly) homogeneous fashion, most do not. Those capable of exercising power

[211] The teacher-neophyte relationship is one primarily characterized by a disparity in authority, and is a central element in PTSI as it relates to training (Barnes, 1982). See Rees, 2009 for a detailed empirical case study.
[212] This is similar to Butler's discussion of agency (1997).

are likely to influence others' self-knowledge and self-regulation more substantially than can the average agent. This facet of power is important when considering subjects and bodies, which I discuss—following Butler and Foucault—as functions of productive power, exercised in disparate and heterogeneous ways by the members of a collective.

7.3.3 Knowledge and physical practices

Finally, this argument must return to the relation between knowledge, physical practice, and the collective constitution of entangled ontologies. This facet of my argument is present throughout the chapters preceding this one, and I briefly addressed it above during my analysis of entanglement. Here, I detail some considerations regarding technological physical practice. Specifically, I address the primacy of practice; consider the relationship between intelligibility, ontologies, and physical practice; and further appraise entanglement and physical practice.

It is in the doing that ontologies come into existence. The progenitors of PTSI variously reiterate the primacy of practice (see Barnes, 2001b, Bloor, 2001; Collins & Kusch, 1998). I argue consistently and repetitively throughout this thesis that social practices are the basis of artefact, subject, and body ontologies. A fundamental component of social practice is *physical* practice. Thus far, physical practice constitutes a considerable component of my empirical data, but remains somewhat under-examined in relation to the central considerations of this thesis: intelligibility and ontology. Despite the importance of verbal utterances—analytically with respect to the Strong Programme and methodologically with respect to the use of interviews—no study of technological artefacts should omit physical usage.

Exploring the role of physical practices demands a consideration of how these are implicit in the enabling and constraining of artefact, subject, and body ontologies, as well as the manner in which physical practices are themselves vulnerable to conventional constraint. This analysis benefits from the work of Harry Collins and Martin Kusch (1998), who draw upon aspects of the Strong Programme in their morphological study of action. The two authors develop the notion of formative intentional actions, which are characterized by their conscious execution[213] and their capacity to "constitute a community, a collectivity, or a

[213] I follow Kusch and Collins (1998) in their definition of actions as "things one can *intentionally* do *in a society*" (Collins & Kusch, 1998: 6, my emphasis). These are contrasted with behaviours, which

form of life." (Collins & Kusch, 1998: 10) I have previously argued that all technological physical practices are formative. That is, all intentional physical practices involved in the usage of artefacts are formative of particular collectives[214]. Motorcyclists belong to a broad collective of agents capable of driving a motorcycle. More specific physical practices may differentiate subjects' participation in and familiarity with communities and their conventions.

Importantly, physical practices and communities are related to each other dialectically. Communities are constituted by and can be identified through their shared practices; concurrently, conventional physical practices are products of communities. This dialectic betokens a deep relationship between the distributions of knowledge and physical practices that characterize communities. Collins and Kusch argue:

> Members of the same form of life share in a common net of concepts and actions. That is to say, they agree in their concepts because they share a realm of possible actions, and they agree in their actions because they share a common network of concepts. Actions and concepts are tightly intertwined because intentions are conceptual, and because concepts provide guidance for actions. (Collins & Kusch, 1998: 11)

In social life, knowledge and physical practice are deeply intertwined. Analytically, it is beneficial to separate them to discern their mechanisms of interrelation, although their reciprocity is sufficient so as to make such a clear divide effectively impossible. This conclusion has considerable ramifications for my understanding of intelligibility and physical practices. Technological physical practices are conventional; they are constitutive of and sustained by specific communities with identifiable conventions and localized particularities. Thus physical practices are made intelligible by the very same distributions of knowledge that render artefact, subject, and body ontologies intelligible. This presents no small measure of difficulty for my mapping of the relationship between knowledge, practice, and ontologies.

The concept of entanglement suggests that artefact, subject, and body ontologies share a common social basis; these three are entangled insofar as their ontologies are enabled and constrained by identical social processes. Physical practice is one of several mechanisms via

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consist mostly of physical movements and machinic motions. Behaviours are susceptible to physical mimicry by uninitiated individuals; actions can only be carried out by those competent in the specific conventions. See Schutz, 1972 [1932] for a similar argument.

[214] See Schyfter, 2009.

which artefact, subject, and body ontologies are enabled. These ontologies reflect the distributions of knowledge characteristic of the communities within which they are enabled; their intelligibility is a function of the community. Physical practices are rendered as intelligible in the same manner, but are also formative of the very conceptual frameworks and communities within which they gain this intelligibility.

Thus, the relationship between knowledge, physical practices, and the community stands as follows. Conventional physical practices are classified and rendered intelligible as are other occurrences in the social world. As such, they exist by virtue of knowledge distributions and communities. Nevertheless, physical practices also serve to distinguish members of communities from neophytes and those excluded, and in doing so delimit the boundaries of the collective.

The practice of touching one's knee to the ground is intelligible as a mark of distinction to those competent in the conventions of Tico Superbikes. Thus the physical practice is classified by members of the collective as a sign of motorcycling proficiency. Concurrently, the practice delimits a select group of riders within the community capable of performing dangerous but impressive feats of technological usage. In that sense, the physical practice performs the boundaries of this elite grouping of motorcyclists.

Physical practice is a central component in the ontological constitution of artefact, subject, and body ontologies, and its function in delimiting community membership is crucial in giving motorcycles their character, negotiating subjects' membership within communities, and classifying bodies as skilled or unskilled.

7.4 Critiques and responses

In addition to outlining and exploring my notion of entangled ontologies and discussing its relationship to a set of principal sociological considerations, this chapter addresses possible critiques to my work. I believe that responding to and defusing this range of arguments strengthens my own. Moreover, this section contributes to the development of PTSI by pre-emptively engaging with possible criticisms.

Since its inception, the Strong Programme in the sociology of scientific knowledge has contended with numerous criticisms from a variety of disciplines—some notable critiques

include those from the philosophy of science (e.g. Laudan, 1981), the sociology and anthropology of science (e.g. Latour, 1993), and ethnomethodology (e.g. Lynch, 1992a and 1992b). Although this thesis deals with PTSI and not the original four tenets[215]—the primary targets of critique—it nevertheless is susceptible to arguments against the Strong Programme. Here I address what I consider to be the central counter-arguments against my work—idealism, reductionism, and the fallibility of symmetry—and respond to them.

7.4.1 Idealism[216]

The charge of idealism levelled against the sociology of knowledge—and particularly against the Strong Programme[217]—is posited upon the presumed contradiction and opposition of realism and constructivism, often defined in suspect or un-nuanced terms. At its core, this argument claims that the sociology of knowledge, in conceptualizing of and studying knowledge claims as social institutions, ignores or at best elides the importance and influence of the 'real world'—of materiality. The self-referential character of social institutions suggests to the critic that sociologists of knowledge deny reference to any existent, external, and independent reality; knowledge becomes simply 'talk about talk'. Bloor summarizes the accusation as follows:

> The charge comes down to this: sociologists of knowledge portray the world as if it depended on belief, rather than belief depending on how things stand in the world. In other words, the accusation is one of *idealism.* (Bloor, 1996: 839, emphasis original)

The charge of idealism should be familiar to a number of disciplines—and to any researcher who employs, to whatever degree of commitment, social constructivism. Salient and relevant examples can be found in gender studies. So-called 'radical' feminist studies of the sexed body—such as Butler's *Bodies That Matter*—consistently posit arguments amenable to a Strong Programme analysis (see Rafanell, 2003 and Chapter Six). These arguments—which suggest that the body as a sexed entity is a social institution—have been met with expansive accusations of idealism (e.g. Nelson, 1999; Hughes & Witz, 1997). Similar arguments regarding subjects and subjectivity (e.g. Butler, 1997) have encountered critique (e.g. Digeser, 1994). Neither is the debate unfamiliar to sociologists of technology, as I discuss in

[215] Causality, impartiality, symmetry, and reflexivity. See Chapter Three.
[216] Much of this sub-section is drawn from David Bloor's 'Idealism and the sociology of knowledge' (1996).
[217] See Bloor, 1999a and 1999b, and Latour, 1999a.

Chapter Eight. My work has three arguments with which to respond to the accusation of idealism.

At the most rudimentary level, my argument can be defended through the character of the my theoretical tools; the Strong Programme employs a realist ontology. Those who developed the Strong Programme have consistently recognized the importance of the material world in the sociological study of knowledge, and have explicitly and repetitively stated their commitment to an analysis of knowledge that appreciates and incorporates this materiality (see Barnes, 1982: 25; Bloor, 1991 [1976]: 33-36 and 1999: 87-91). PTSI is founded upon this theoretical commitment, and in dealing with natural and artificial kinds, discusses the existence of spatio-temporal entities and the necessity of external, independent materiality for acts of classification and cognition (Barnes, 1983; Kusch, 1999). Nevertheless, such a defence against charges of idealism—while worthwhile and necessary—is limited and somewhat circular.

A more robust counter-argument to accusations of idealism is found in the empirical data from Chapters Four, Five, and Six. In my various analyses, I consistently note the participants' referral to the material character of their motorcycles, as well as their own and others' corporealities in constituting the ontologies under examination. The material world—empirically and analytically—constitutes a component within the process of classification and the constitution of entangled ontologies. It is necessarily implicated in our knowledge about, interaction with, and experience of artefacts, subjects, and bodies. Nevertheless, materiality does not classify itself. The data overwhelmingly demonstrates that artefact ontologies are conventional—despite material equivalency. Similarly, subjects are accountable to numerous—and often contradictory—subject positions despite their physical unity. Lastly, identical bodies are classified in concordance with the social practices of the collective within which they are situated. Entangled ontologies are constituted in accordance with local knowledge and practices, buy they are not 'talk about talk'. They draw upon and recast empirical observation.

A third defence here is my discussion of physical practice. In studying technological artefacts, it is necessary to document, understand, and analyze the physical experience of operating them. Artefact ontologies are constituted in relation to the physical practices expected of those who use the technology, just as these practices can be circumscribed or enabled by the artefact's materiality. Subjectivities are often enabled through—among other

considerations—physical acts, displays, or qualities. Moreover, certain subject positions can be inaccessible due to corporeal limitations. Finally, bodies are unquestionably classified in reference to corporeality. I discuss and demonstrate the interaction between convention and materiality in acts of body classification. In these three instances, physical practices—such as technological use—are central to the ontological constitution of artefacts, subjects, and bodies. Ontologies owe their existence to more than self-referential 'talk'. The material plays a substantial—though never deterministic—role in their development.

7.4.2 Reductionism

With entangled ontologies, I suggest that the processes of ontological constitution of artefacts, subjects, and bodies have a common, social basis. Analytically, this implies a change in the conceptualization of these entities and a newfound concern for the question concerning ontologies; methodologically, this framework necessitates a focus upon shared practices and knowledge. In positing a common foundation for artefacts, subjects, and bodies, entangled ontologies elucidates and streamlines the myriad relationships between the three classes of entities. A critic might suggest that my analysis unwarrantedly simplifies a number of complex phenomena. This same critic might claim that my argument tactically disregards empirical intricacy—characterized by contradiction, tension, and idiosyncrasy—in favour of analytic simplicity. I call this the charge of reductionism. This critique focuses upon my methodological and explanatory practices, rather than the implications of my argument, as does the critique of idealism. I believe that in suggesting reductionism, the hypothetical critic mischaracterizes my empirical work and this thesis' central argument.

Predictably, the various participants of my study did not respond identically to the questions I posed, but rather answered them in a manner that reflects individual particularities and the lack of absolute concordance between agents in a collective. However, the sociological arguments concerning, for instance, heteronormativity in gender relations in Latin America, are more than analysts' constructs. These are the consolidation and interpretation of complex and heterogeneous empirical data. While not every participant proffered identical responses concerning gender and sexuality, their different answers did conform to broad social conventions, and analytic induction was possible. Additionally, stark contradictions are present in the empirical case material. In Chapter Four, the participants report that symbiotic relationships between rider and motorcycle display clear power disparities, and are never equitable. In Chapter Six, again discussing symbiosis, the participants note the perfect equity

between agent and artefact. Contradiction is inherent to the data, and reflects the heterogeneity of social life. I discuss this specific example of empirical tension in Chapter Six.

PTSI engages directly with the topic of individual idiosyncrasy and collective consensus (Barnes, 2001b). Rather than elide this question—as the critic might suggest—PTSI discusses the inevitable 'drift' of individual practice from the community. Individual practice is contradictory, often in tension with previous practice and with others' practices, and never exactly in conformity with the communal consensus. I note this phenomenon throughout the thesis[218]. In this sense, my work engages with complexity both at the empirical level—by identifying, discussing, and accounting for difference—and at the analytic level—through PTSI's recognition that social institutions are enabled by and sustained through heterogeneous practices. My considerations of social order and power above lend further credence to this claim.

The central arguments of entangled ontologies is also mischaracterized by the charge of reductionism. My positing of a common, social origin for these ontologies does not elide their complexity or simplify their study in favour of analytic expediency. In order to explicate the development of particular ontologies, as well as identify and account for the limits of their intelligibilities, the researcher must adeptly discuss the local traditions, precedents, paradigms, and patterns that form the basis upon which ontologies are developed and sustained—a laborious task. This same researcher must engage with ostensibly individualistic phenomena, such self-knowledge, and reconcile these with a communitarian epistemology—again no small feat. Suggesting that these phenomena are social in no way implies that they are 'just' social[219], or that by virtue of their sociality they are suddenly simpler problems.

Importantly, entangled ontologies does not reduce all phenomena to artificial kinds. While a tempting claim to make—given my foci within this thesis—this sociophilosophical analysis requires the existence and uniqueness of both natural and social kinds. My use of artificial kinds is necessary to discuss the three phenomena I chose to study because of their unique relationship to materiality and their fundamentally social character. Nevertheless, the

[218] One example is my discussion of aged subjectivities and self-knowledge in 5.4.6.
[219] By which the intended meaning is: limited to, nothing but, or arbitrarily social. This particular accusation is infuriatingly common.

concept of entangled ontologies is not a 'theory of everything'; it makes no claim to the ontological character of entities not directly addressed above.

The aim of my sociophilosophy is not simplification, but rather a re-positioning of key questions. My use of PTSI explores the usefulness of ontologies as an analytic tool and to elucidate a new set of problems—concerned with intelligibility and social processes—in the study of technology. Symmetrical analysis—drawn from the Strong Programme and at the core of entangled ontologies—introduces new problems and considerations to this discipline. In analyzing artefacts, subjects, and bodies equally and as inter-dependent social phenomena, I do not practice reductionism. Rather, it becomes possible to draw from work on one class of entities and employ it to further problematize the other two. For instance, I use the literature on age and ageing that deals with subjectivity in exploring the importance of age in relation to technological artefacts. Entangled ontologies is thus most successful in strategically complicating—not simplifying—the study of artefacts, subjects, and bodies.

7.4.3 Symmetry: Negotiating a stance

The most prominent aspect of the Strong Programme—and its most assailed characteristic—is the tenet of symmetry (the symmetry principle). I engage with and re-interpret symmetry throughout this thesis and must respond to various criticisms born out of this analytic proposition. Specifically, I must contend with two critiques: first, that my use of the symmetry principle distorts and misapprehends the original tenet; second, that I do not successfully negotiate the course between the Strong Programme's symmetry and Actor-Network Theory's generalized symmetry.

Let me dispense with the first argument: that my use of symmetry is not warranted by the Strong Programme. In establishing the methodology of the Strong Programme in the sociology of scientific knowledge, Bloor states that such a program:

> … would be symmetrical in its style of explanation. The same types of cause would explain, say, true and false beliefs. (Bloor, 1991 [1976]: 7)

More than its three companion principles, symmetry has been targeted by philosophical (Laudan, 1981) and sociological (Latour, 1999b) students of science. As this thesis is not directly concerned with issues of truth/falsity, rationality/irrationality, success/failure, or

indeed scientific knowledge, I will not rehearse these complex debates[220]. It suffices here to note that the symmetry principle was established for the explicit purpose of rendering comprehensive causal accounts of the development of scientific knowledge claims. It was not intended for the sociology of technology, nor was it developed for ontological questions—the symmetry principle is a methodological tool designed for questions of epistemology in the study of scientific knowledge. Thus far, it appears that my suggestion of symmetrical analyses of artefact, subject, and body ontologies is wide of the mark. Nevertheless, this study conforms to and advances symmetry methodologically and analytically.

Methodologically, I conform to the symmetry principle insofar as I uncover the shared bases for artefact, subject, and body ontologies. That is, my research explains our understanding of these three by reference to the same sociological causes. My empirical work documents these shared causes. Although my aim is not to distinguish between the success of one knowledge claim over another, the underlying mode of research is comparable and compatible with symmetry's original formulation.

Analytically, this thesis develops—but does not distort or misapprehend—the symmetry principle. As the first work to deploy PTSI in the sociology of technology[221], this is one of few that has attempted to use symmetry in studies of technology. Additionally—and more notably—my use of the symmetry principle extends beyond questions of epistemology. I discuss the ontological constitution of artefacts, subjects, and bodies symmetrically[222]. My analysis thus follows the notion of equal causal explanation, but addresses an entirely different set of philosophical and sociological questions.

The principal tension that has characterized the debate between the Strong Programme and Actor-Network Theory (ANT) rests precisely upon this point. Proponents of ANT advocate 'generalized symmetry', whereby human and non-human entities receive equal sociological treatment. Collins and Yearley summarize the position, as well as some of its difficulties:

> … French-style radical symmetry draws no boundary between objects that have been created and those that occur naturally. Here we run into some difficulty of

[220] See Bloor, 1981 and 1999b for his replies.
[221] Pinch and Bijker work with the Empirical Programme of Relativism (1984; Collins, 1983) and MacKenzie's numerous works (e.g. 1993 and 1998) draw from the Strong Programme, but not PTSI.
[222] Pinch and Bijker discuss *meaning* (1984), not ontology. I consider meaning to be a higher-order phenomenon than ontology, and do not believe the two to be identical considerations in sociology.

> interpretation, for if the whole subject matter is signs and representations, it is hard to know exactly how we should make the distinction between that which occurs naturally and that which is made. (Collins & Yearley, 1992: 312)

Simply stated, the Edinburgh interpretation of symmetry is a methodological position (methodological relativism), while that of ANT is a metaphysical proposition (metaphysical relativism). In studying ontologies, and discussing symmetrical studies of artefacts, subjects, and bodies, I drift perilously close to ANT, while at the same time arguing against their interpretation of non-human agency, universal 'actants', and the needlessness of a social-natural divide (see Akrich & Latour, 1992; Latour, 1992 and 1999b). Like other proponents of the Edinburgh School, I maintain the necessity of an analytic distinction between social and natural *contra* ANT (see Bloor, 1999a). A critic might suggest that my position is untenable.

My use of symmetry in discussing ontologies remains consistent with PTSI and the Strong Programme and opposed to ANT. The crux of the matter rests with the relationship between epistemology and ontology. Bloor, in critiquing ANT, states:

> Latour makes no systematic distinction between nature and beliefs about, or accounts of, nature. He repeatedly casts the argument, his own as well as that of his opponents, in terms of nature itself rather than beliefs about it… It is as if he has difficulty telling these two things apart. (Bloor, 1999a)

In discussing scientific knowledge of nature, this criticism is well aimed. In discussing entities reliant upon self-referential social practice, the argument misses the fundamental interrelation between knowledge and ontology. For self-referential kinds—artificial and social kinds—it is knowledge that sustains an entity's existence within a community. Without knowledge (and its accompanying practices), marriage (S-kind) does not exist, nor do motorcycles (A-kinds). Questions of epistemology are invariably linked to questions of ontology. I do not hold, and this thesis does not argue, that artefacts, subjects, and bodies are metaphysically equal. I do contend, and this thesis does claim, that their ontologies are functions of equal practices, and should be studied as such. That differences exist is unquestioned and sociologically important; that their ontologies require symmetrical analysis is the thrust of my argument. Finally, it is worthwhile to note that this thesis provides a symmetrical analysis of human and non-human entities while avoiding bestowing human capabilities—such as knowledge, self-knowledge, and agency—upon non-human things. Thus, I achieve many of the aims of generalized symmetry without subscribing to its notion of human / non-human equality.

7.5 Beyond this thesis

This chapter develops my concept of entangled ontologies, considers its relationship to various sociological considerations, and engages with some possible critiques of my work. While entangled ontologies was developed as a mechanism with which to grapple with my empirical fieldwork and discuss the usefulness of PTSI for the study of technological artefacts, subjects, and bodies, I believe its applicability to be greater than its employment within this volume. Here, I primarily concern myself with justifying my use of the Strong Programme and demonstrating the social character of the ontologies under scrutiny. By way of concluding, I consider some wider implications of sociophilosophical analyses, entangled ontologies, and methodological symmetry.

Chapter Eight: Implications

The seven preceding chapters present three broad analytic arguments, one theoretical proposition, and a detailed empirical case study. I systematically argue for my use of the Strong Programme's Performative Theory of Social Institutions in analyzing technological artefacts, subjects, and bodies as artificial kinds, and support my claims with empirical data. I also contribute three original empirical arguments, dealing with heteronormativity, age, and embodiment, and demonstrate their significance and relevance to my theoretical work. Last, I proffer the notion of entangled ontologies as a useful analytic tool for studying the concurrent ontological constitution of artefacts, subjects, and bodies. While I signal the relevance of my work to a multitude of academic disciplines throughout this thesis, such considerations are somewhat limited. In concluding this thesis, I engage with a number of its implications.

My research draws upon a broad constellation of scholarship and as such, I could proffer a long list of possible contributions that this thesis makes to academic enquiry. However, with textual brevity and intellectual honesty in mind, I here focus on three areas of research upon which this thesis might contribute positively—feminist technology studies, the sociology of technology, and the philosophy of technology.

For feminist technology studies, I address the co-production of gender and technology—the foundational concept from which I developed my understanding of the social character of technological artefacts, as well as the relationship between subjects, bodies, and technologies. Following Catherina Landström, I identify some limitations of the co-production formula, discuss their ramifications for future research, and propose entangled ontologies as a methodological and analytic contribution to studies of gender and technology.

In my consideration of the sociology of technology, I engage with the debate between Steve Woolgar and Keith Grint's thoroughgoing interpretivism and Rob Kling's reconstructive interpretivism. This series of articles and responses consolidates a number of arguments against and for social constructivism—ones still relevant for social studies of technology. I recapitulate the debate, identify the principal strengths of each argument, and consider the

usefulness of both approaches. I then suggest that my use of artificial kinds mitigates some major disagreements between 'strong' and 'weak' forms of constructivism.

Lastly, I consider the relevance of my work for the philosophy of technology, particularly as it relates to the question concerning ontologies. I review approaches taken by philosophers of technology in discussing the ontological question and discuss the increasing synergy between philosophical and sociological accounts of artefacts. I explore Clive Lawson's recent work on artefacts as a close analogue to my own, and identify the divergences between our analyses. Finally, I consider the positive contributions of my research to the philosophical study of technology.

Having considered the implications of my work for each of these research foci, I briefly conclude the thesis with a discussion of new research in the Edinburgh School.

8.1 The implications for feminist technology studies

This thesis began as a contribution to feminist technology studies and despite its expanded focus, it retains gender as a substantial consideration—both empirically and analytically. While no longer exclusively pertinent to studies of gender and technology, my research remains applicable to feminist technology studies. My use of the Strong Programme builds upon the dominant traditions of this field and responds to recent critiques—particularly those of Catherina Landström (2007). Most significantly, my analytic approach can rectify some consequential shortcomings of the co-production thesis.

Originally conceived as the 'mutual shaping of gender and technology' (Cockburn & Ormrod, 1994) and then the 'co-construction of gender and technology', the co-production thesis is the fundamental tenet of contemporary feminist technology studies and its most employed theoretical framework[223]. The formulation of the thesis, derived from earlier studies of society and technology, advocates a reciprocal understanding of gender and technology:

[223] For a more comprehensive review of feminist technology studies and its theoretical approaches, see Lohan, 2000, and Wajcman, 1995 and 2000. For a variety of studies that discuss and/or employ the co-production thesis, consult: Cockburn, 1999; Cockburn & Fürst Dilič, 1994; Cockburn & Ormrod, 1993; Hacker, 1989; Lupton, 1993; Oudhsoorn 2003; van Oost, 2003; and Wajcman, 1991 and 1998.

> … in line with social studies of technology, they assumed a two-way mutually shaping relationship between gender and technology in which technology is both a source and consequence of gender relations and *vice versa*… (Faulkner, 2001: 81, emphasis original)

Co-production aims to discern the various, intricate links between the social constructions of gender and of technology, employing one as the explanatory framework for the other. Gender impinges upon the development of technology, just as technology influences the construction of gendered symbols, structures, identities, norms, expectations, and so forth. Put otherwise:

> A most important meeting point is in the attempt to analyze technologies and gender as social constructs. This means that gender is important in the social construction of technology and that technologies are important in the social construction of gender. (Berg & Lie, 1995: 345)

Co-production posits reciprocity between gender and technology—methodologically, analytically, and theoretically. Crucially, co-production demands equal treatment of the 'gender question' and the 'technology question'.

Landström's discussion of feminist technology studies (2007) poses a number of criticisms of co-production and the manner in which it has been employed by students of gender and technology[224]. Most important here is her claim that feminist technology studies has failed consistently to adopt the symmetrical methodologies and develop the balanced analyses implied by co-production:

> This 'black-boxing' of gender undermines the aim to understand the coproduction of gender and technology. If gender is already there, as a fixed element it can only function as a cause in relation to the socially constructed technology. (Landström, 2007: 10)

Landström faults feminist technology studies for failing to apply constructivist analyses to gender with the same fervour as they do for technologies. Furthermore, Landström argues that in shifting between technology and gender as explanatory factors, the researcher necessarily reifies the causal element in making the other a variable subject to constructivism:

[224] See Chapter Four for a discussion of her other criticisms of feminist technology studies.

> The gender identities of technology designers and users are treated as stable traits that precede the creation of a malleable technology. (Landström, 2007: 10)

Co-production does not allow for concurrent constructivism. Her critique is similar to that of Lerman et al., who identify imbalances within gender and technology case studies:

> … this scholarship tends to challenge traditional conceptions either in gender studies or in technology studies, while uncritically accepting familiar traditions in the other. (Lerman et al., 1997: 17)

Both articles argue that one phenomenon receives prominence at the expense of the other. These critiques are well aimed. A considerable proportion of feminist technology studies literature offers robust arguments for the constructed character of technology while concurrently eliding the vast constructivist literature on gender[225]. Nevertheless, Landström and Lerman et al. fail to identify co-production itself as the head and source of this asymmetry.

The primary limitation of co-production, I argue, is its bi-linear model of gender and technology. Gender is employed to explain the final form of technology, and technology is responsible for elucidating the character of gendered phenomena. While co-production was intended to supersede the 'mutual shaping' framework by making this bi-linearity more malleable and simultaneous[226], the newer approach retains a two-way conceptualization of symmetry:

> The symmetry of this analytical framework suggest that just as one cannot understand technology without reference to gender, so one cannot understand gender without reference to technology. (Faulkner, 2001: 90)

This approach is useful in elucidating the importance of gender in technology studies[227], but it is not symmetrical. Social phenomenon A (gender) is employed to explain social phenomenon B (technology), while social phenomenon B explains A. The two are explained using *different social causes*. The approach is reciprocal, but not symmetrical.

[225] Note that the reverse is also true. Gender studies scholars regularly fail to problematize technology while developing sophisticated analyses of gender (Faulkner, 2001).
[226] Indeed, the use of the term 'production' signals an ostensible alliance with post-structuralist and/or performative theories of gender, which emphasize its active constitution.
[227] As it might be for ethnicity, class, or age.

I believe this difficulty arises from co-production's origin in the 'social shaping of technology'. This approach—more accurately, this collection of approaches—consistently and conspicuously makes divisions between 'the social' and 'the technical' (see Williams & Edge, 1996), often identifying the latter as non-negotiable, and asocial[228]. The term 'sociotechnical' consolidates this divide, in implying that the two must be reconciled and suggesting that they co-exist in a heterogeneous web composed of social and technical elements capable of effecting change on each other. Gender, as an element of 'the social', has considerable effects upon technology (and vice versa):

> ... the notion of the "sociotechnical" in technology studies captures the sense that technology and society are mutually constituting—hence, the coproduction of gender and technology. (Faulkner, 2001: 90)

'Sociotechnical' stabilizes a separation between society and technology, and contributes to the bi-linear character of co-production. The term excises technology from society, as a phenomenon that is to be understood *in relation to* society rather than as *a fundamental component of* society[229].

Finally, this analytic formula makes feminist technology studies research myopic to other social phenomena. Contemporary work in gender studies is increasingly concerned with intersectionality[230]. A bi-linear model of gender and technology makes it difficult to address the ramifications of various overlapping social orders. While no analysis will ever encompass all aspects of social life, attempts to incorporate numerous social causal factors are worthwhile, as my empirical study demonstrates. Co-production limits the scope of enquiry to gender and technology as primary (and sole) causes.

I contend that my use of artificial kinds and the notion of entangled ontologies have useful analytic consequences for feminist technology studies. First—and most directly concerned with my and others' critiques of co-production—is the introduction of the tools necessary for symmetrical studies of gender and technology. In adopting a Strong Programme analysis, the

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[228] Lohan summarizes this perspective as follows: "A 'social shaping' or 'constructivist approach' to technology means locating technology as a heterogeneous network of the technical and the social, or as 'sociotechnical ensembles.'" (2000: 898) The separation between technical and social is evident.

[229] 'Sociotechnical' stabilizes a separation between society and technology that is not present in the use of the words 'society' or 'technology' by themselves. Social researcher feel no need to use terms such as 'sociogender' or 'socioartistic'; both gender and art are understood as part, parcel, and product of society, as should be technology.

[230] See Narayan & Harding, 2000. For another discussion and overview of intersectionality in gender studies, see Phoenix & Pattynama, 2006a. For a collection of articles on intersectionality, see the *European Journal of Women's Studies*, vol. 13, iss. 3 (Phoenix & Pattynama, 2006b).

researcher no longer studies the effects of gender on technology and vice versa; rather, the focus is upon the common social factors that constitute the two in their particular modalities. The research question shifts from effects (premised on a divide between 'social' and 'technical') to rules of intelligibility (premised on the irrevocably social character of technology). In abandoning the bi-linear model of social construction, entangled ontologies allows for analyses that explicate technology and gender (and other social orders) with equal emphasis.

Second—and in response to Landström's critique—PTSI avoids 'black-boxing' technology *and* gender. The researcher is compelled to interrogate the manner in which both are constituted. Rather than study two processes of influence, entangled ontologies examines artefacts, subjects, and bodies equally and concurrently from the start.

Third, PTSI's concern with social practice makes possible robust studies of intersectionality. As I argue in Chapter Seven, studies that incorporate a multitude of social orders—such as gender, sexuality, and age—render more comprehensive accounts of the concurrent constitution of artefacts, subjects, and bodies. Intersectionality studies have contributed substantially to gender studies, and can achieve similar success in technology studies. As I argue above, entangled ontologies systematically problematizes artefacts, subjects, and bodies and makes disciplinary exchange necessary.

Last, PTSI has positive implications for feminist politics and praxis. Most obviously, by making the use of gender studies literature analytically necessary, entangled ontologies can improve dialogue between gender studies and feminist technology studies, thus drawing together various political aims and approaches hitherto developed somewhat disparately. Linked to this is my research's focus on underlying social practices. If ontologies are constituted by virtue of fundamental social orders, then looking to the consequences of these conventions—consequences such as discrimination and oppression—is a requisite of my sociology of technology. Finally, my concern with rules of intelligibility makes finding the targets of feminist politics—the norms and conventions responsible for gendered symbols, identities, structures, and so forth—a central component of technology studies research.

8.2 From 'social shaping of' to 'social' full stop: Constructivism in technology studies

For a wider body of scholarship—namely, social studies of technology—my work holds relevance insofar as it contributes to a long-standing debate concerning the usefulness and appropriateness of social constructivism to studies of technology. Represented in a collection of discussion papers and responses by Steve Woolgar and Keith Grint—advocating 'strong' constructivism and discourse analysis (Woolgar, 1991; Woolgar & Grint, 1991)—and Rob Kling—supporting the more tempered 'reconstructive interpretivism' (1991 and 1992), this debate is critical to social enquiries of technology.

Primarily, the discussion addressed the extent to which artefacts could—and indeed should—be considered social entities or simply components within broad 'sociotechnical' systems. Woolgar and Grint advocated the use of thoroughgoing interpretivism—in the form of technology as discourse—over Kling's reconstructive interpretivism—which dismisses such an analysis as making technology 'itself' irrelevant. The 'strong' interpretivist camp argues that reducing constructivism to a 'social shaping of' approach is insufficient:

> By construing interpretive processes as primarily giving rise to 'labels,' one mistakenly implies that the 'actual' technology preexists (or exists independently of) interpretive process. By contrast, in recognizing the constitutive function of interpretation, one accepts that the nature and capacity of a technology arises in and through the discourse of which it is part (Woolgar & Grint, 1991: 374)

Woolgar and Grint's 'technology as text' approach is outwardly indistinguishable from my artificial kinds analysis, and Kling's central critique is commensurable with my discussion of reductionism and idealism in Chapter Seven:

> Grint and Woolgar distrust technology as a category, since their arguments show that descriptions of technologies can always be unpacked to reveal fundamentally social choices, configurations, beliefs, and interpretations. Their analytical practice treats any talk about technologies as nothing more than arbitrary social fictions. There is no technology in their 'sociology of technology'. (Kling, 1992: 384)

In response, Woolgar and Grint reframe the question. Rather than appraise the role of technology 'itself', they explore the manner in which artefacts become relevant, a process they argue is social in character:

> …we do not argue that the bullet (technology) is irrelevant but that the process by which it achieves relevance is irredeemably social. (Grint & Woolgar, 1992: 377)

The debate found concrete articulation in the case of guns, deadly wounds, and the politics of violence in Los Angeles. Kling argued that the bullet itself, as well as the wound it causes, is not irreducibly social. Gun violence in Los Angeles must be critically analyzed by scholarship that recognized the technology 'itself', and consequently is not politically impotent[231]. In response, Woolgar and Grint argue:

> The politics and values of technology result from the gaze of the human; they do not lie in the gauze of the machine… Technological practices and descriptions of technology, by which we come to know it, necessarily embody social and political values, but these do not lie within the hard creases or soft folds of the machine. (Grint & Woolgar, 1995: 306)

In contrast, Kling allies himself with those who find politics in the materiality of the artefact itself (e.g. Winner, 1980)[232]. Although he makes an attempt to reconcile his interpretivism with Woolgar and Grint's more 'radical' approach (1992), the two positions inevitably arrive at a point of incommensurability and remain alternate approaches to the social study of technology.

My use of PTSI perhaps initially appears to be nearly indistinguishable from Woolgar and Grint's thoroughgoing interpretivism, and while my position is more allied with their's than that of Kling, I disagree with the former's uncritical disregard for materiality. As such, I posit an alternative resolution to this important debate within STS.

My use of artificial kinds renders a more robust conceptualization of technological artefacts than do thoroughgoing interpretivism—technology as text—or reconstructive interpretivism—technology as physical object. My focus on ontologies does not reduce technologies to either discourse or physical entities. Instead, it recognizes the material constitution, consequences, and experience of artefacts while concurrently accepting that our understanding of artefacts *qua* artefacts is irrevocably a social-kind status. Nor is my approach a capitulation of Woolgar and Grint's constructivist position[233], but rather an analysis that appropriates their concern with knowledge and social practice inside a realist

[231] Winner, 1993 argues similarly.
[232] For a discussion concerning the materiality of technological politics, see Winner, 1980; Joerges, 1999; and Woolgar & Cooper, 1999.
[233] Arguably, saying that technology is socially constructed is commensurable with saying its ontology is a social institution. See Bloor, 1997a.

framework directly concerned with the material experience of technology. As I argue extensively, recognizing physical practices and materiality does not diminish the social character of technological artefacts, nor does it posit a non-social 'technical' facet of artefacts[234].

Additionally, my use of ontologies avoids a major difficulty with Kling's analysis; namely, the separation of the physical technological artefacts from its 'social influences'—a problem ubiquitous in technology studies. Technological artefacts exist only insofar as they are positioned within social practices. Outside society, technologies do not exist; the physical substrate is not an artefact. Kling's common assertion concerning the technology 'itself' misses this fundamental point. Claiming that there exist 'social influences upon' the technology posits technology as something outside of society. The suggestion that we can have technology without society is untenable and flies in the face of decades of high-calibre work in technology studies. Our knowledge and use of technologies, as well as 'their' politics, stem from conventional social practice. Importantly, conventional does not entail arbitrary, as Kling suggests. There are identifiable—and possibly even material—causes that explicate the character of artefact ontologies[235]. Moreover, my analysis is not politically ambivalent, as Kling suggests of Woolgar and Grint's. The politics that Kling seeks to address are found in the very rules of formation which give rise to our understanding of artefacts—such as guns—and the material consequences of using artefacts—such as gun deaths.

[234] Williams and Edge write of the 'social shaping of technology' (SST): "Alongside narrowly 'technical' considerations, a range of 'social' factors affect which options are selected—thus influencing the content of technologies, and their social implications." (1996: 866). Of the concept of the 'sociotechnical', Faulkner writes: "... technology is never 'just' technical or 'just' social. Rather, the relationship between technology and society is a densely interactive *seamless web*." (2001: 82) These quotations indicate some serious problems with SST. The 'technical' is considered either asocial or synonymous with 'materiality', either of which is profoundly mistaken. Such statements also suggest that some 'technical' considerations are inevitable, while in actuality all choices in technological decision-making are social practices.

[235] "If one has a sense that social activity is patterned, or other than random, then one may become curious about what it is which maintains the pattern. If one has a sense that social activity cannot be whimsically and arbitrarily modified, one may become curious about what it is which generates whatever resistance there is to modification." (Barnes, 1981b: 494)

8.3 Technology, philosophy, and social theory: The question concerning ontologies

This research stands to resolve questions that extend beyond science and technology studies, particularly with relation to the interface between the philosophy of technology and social theory. Recent (Kroes & Meijers, 2006; Lawson, 2008) and longer-standing (Heidegger, 2003 [1954]) enquiries into the ontology of technological artefacts have posited numerous solutions to the 'question concerning technology', and have reconciled social and philosophical perspectives in different proportions and with varying degrees of success. Current work in the philosophy of technology embraces and incorporates sociological explanations of technology in a more consistent manner than have previous philosophical explorations of technology. Here I consider how my sociophilosophical work can contribute to this increasingly synergetic dialogue.

Much contemporary research in the philosophy of technology adopts a two-fold conceptualization of technology as both a structural/physical entity and an intentional/social object—this very much in concordance with many 'social shaping' approaches within STS. However, unlike STS, the philosophy of technology remains predominantly preoccupied with discerning the 'essence' or fundamental character of technology, a project in many ways initiated by Heidegger's "questioning technology" (2003 [1954]). Baker's (2004) and Houkes and Meijer's (2006) studies explore the ontological respectability and metaphysics of artefacts, respectively. Neither focus explicitly and specifically on the processual problem of how ontologies are constituted. Other philosophers have taken the concept of function as a central consideration (e.g. Searle 1996 [1995]; Vermaas & Houkes, 2006) and while their attempts to base an ontology of technology upon function are compelling, they are ultimately flawed[236].

More congruent with my own research is Lawson's work, which—while committed to a 'dual nature' interpretation of artefacts—embraces sociological explanation:

> …the form and content of the hammer would not disappear tomorrow if human societies ceased to exist (as say language would). But the hammer, in the eventuality of human societies ceasing to exist, would actually cease to be a hammer; because

[236] Succinctly: function is not determinately established by material structure, it displays social and historical contingency, and depends on conventional physical practices and normativity. For the complete argument, see Schyfter, 2009.

> part of what a hammer is, exists only in relation to those using it. (Lawson, 2008: 54)

This brief excerpt displays substantial similarity to the arguments I present here, and Lawson's primary ontological argument is quite consistent with my own. Nevertheless, he returns to the traditional philosophical project with regard to technology and proffers a definition of artefacts based on fundamental qualities:

> …technical activity is best conceptualised as activity undertaken to harness the intrinsic powers of material artefacts in order to extend human capabilities. As such, technology refers to the material objects that are the (material) conditions and results of this (technical) activity. (Lawson, 2008: 59)

While the author sees his project as reconciling implications-based accounts of technology (such as Heidegger's) and concretization-based accounts (such as those of STS), he fails to avoid reducing technology to a single property: extending human capability. While his use of sociology and philosophy is well developed, the resulting definition of technology curtails a number of important analytic considerations, such as:

> What the introduction of new artifacts means for people's sense of self, for the texture of human communities, for qualities of everyday living, and for the broader distribution of power in society.... (Winner, 1993: 368).

My own sociophilosophical project provides an alternative understanding of ontologies, while simultaneously incorporating the considerations Winner—another prominent philosopher of technology—identifies here. This is immanent to the political ramifications of my work, as I discuss them in 8.1.

As I note in Chapter One, ontologies are our understanding of an artefact's (or a subject's or a body's) being in social life. Our knowledge and use of these entities are responsible for their existence. As such, there exists an invariable overlap between epistemological and ontological studies of technological artefacts (and subjects and bodies).

Sociophilosophical analyses of artefacts can contribute substantially to philosophical accounts of technology. For the philosophy of technology specifically, my use of social theory to resolve critical philosophy questions contributes positively in elucidating and re-framing long-standing concerns with ontology. More importantly, my work displaces a 'dual nature' conceptualization of artefacts in favour of a single-ontology approach, which does

not provide for the existence of a purely material technological ontology. Rather, the only technological ontology is one bestowed upon 'raw' materiality by social practice; there is no 'underlying' technology before or beyond social practice. This conceptualization removes the necessity to negotiate two ontologies (see Vermaas & Houkes, 2006) and discern their connection. A second advantage of displacing a two-fold understanding of artefacts concerns essential properties and fundamental qualities. Much of the research within the 'dual natures' tradition aims to identify the linking mechanism between the two facets and in so doing, discover the unique property of technology (Houkes & Meijers, 2006; Lawson, 2008). Other work, not located within this tradition, continues to argue about metaphysics and technology by developing definitions for and descriptions of artefacts based upon qualities underlying all technology (Baker, 2004). This work marginalizes the process of ontological constitution, and fails to account for the variety of modalities in which artefacts finally take form—both structurally and ontologically. My analysis examines just this: manner and modalities. Exploring these allows me to avoid narrow concepts of technological essence to discover the multitudinous practices underlying our understanding of technology.

Last, the use of social theory—in combination with robust empirical work—can help avoid totalizing accounts of technology[237], such as Heidegger's "revealing" (2003 [1954]) or Lawson's extension of human capability (2008). Monolithic narratives of technology miss a fundamental observation: that artefacts and technological practices are conventional through and through. This claim I work to demonstrate throughout this thesis and is supported by the literature in technology studies. Not only can sociophilosophical research account for the consequences of technological artefacts for social life, but it can render comprehensive accounts of the productive capacity of localized knowledge and practices. Additionally, doing so gives sociophilosophy the critical potential that Winner argues is missing from most constructivist accounts and many philosophical studies of technology.

8.4 In summation: Technology and the Edinburgh School

I consider this thesis' expansion upon the Strong Programme to be one of its defining—if not its most noteworthy—contributions to science and technology studies. In addressing the technology question through PTSI, I position my work within a literature of considerable import (e.g. MacKenzie, 1993; 1996; 1998), and further develop current research within the Strong Programme.

[237] See Law, 2002 for a discussion of multiple, 'fractured' accounts of technology.

My research is situated within an broader movement to reconsider the role, and make use, of the Edinburgh School in the study of science, technology, and medicine. My analysis of artefact, subject, and body ontologies complements studies on forensic medical practitioners (Rees, 2009), drug regulation (Messner, 2008), the sexed and gendered body (Crozier, forthcoming; Rafanell, 2003), gender identity (Soley-Beltran, 2001), and financial markets (MacKenzie, 2006). At the core of this 'new' movement is the Performative Theory of Social Institutions—hitherto a somewhat marginalized aspect of the Edinburgh School. While not the first study to make use of the sociology of scientific knowledge in exploring technology, this thesis is the first to employ PTSI. In doing so, I reiterate the applicability of the Strong Programme to questions of technology, as well as demonstrate its adaptability to the study of ontology. Most importantly, my sociophilosophical analysis re-conceptualizes and augments several key components of the Edinburgh School.

My discussion of underdetermination and finitism establishes the fundamental concordance between the two, and functions to make meaning finitism an operational tool in studying technological artefacts, knowledge, and practices. In employing underdetermination and finitism, I make it possible to study artefacts, subjects, and bodies as artificial kinds, and this latter achievement is linked to my re-imagined symmetry postulate. With a focus on social causality and rules of intelligibility, this modulated symmetry postulate constitutes the methodological and analytic heart of my argument, and evidences the Edinburgh School's malleability and potential for growth.

My interpretation of the symmetry postulate as a tool for analyzing rules of intelligibility and the process of constituting ontologies makes balanced, concurrent studies of artefacts, subjects, and bodies possible. Moreover, such an approach fits neatly with previous and current work on knowledge, artefacts, and social orders—a fundamental consideration for the sociology of technology. Importantly, drawing together studies of scientific knowledge, technological artefacts, and social orders provides for analyses that discuss the immanent position of artefacts in the constitution of knowledge, the role played by scientific practice and knowledge in making artefacts intelligible, and the overarching influence of social orders (see Bachelard, 1984 [1934]). My intended study of age, ageing, and technology will make considerable use of such a synthetic approach.

Finally, my use of the Strong Programme helps me dispense with two profound misapprehensions concerning technological artefacts. First, I demonstrate the employing social causal explanation does not ignore or de-value 'the real'. Studying ontologies—and accounting for these using intelligibility—allows the researcher to address the lived experience of technology while examining the manner and modalities in which we come to understand and use artefacts. Second, I make evident that addressing materiality does not equate to capitulating constructivism. Material is ontologically deficient; 'the technical' is never 'just' technical, never asocial, never removed from intersubjective practices.

Technology is part, parcel, and product of social life and should be studied accordingly. Its inexorably social character should never be compromised, nor its interdependence with subjects and bodies ignored. In drawing these entities together, the researcher can capably shift the focus of research to more fundamental questions of ontology and intelligibility. Foucault writes:

> What we must do, in fact, is to tear away from their virtual self-evidence, and to free the problems that they pose; to recognize that they are not the tranquil locus on the basis of which other questions (concerning their structure, coherence, systematicity, transformations) may be posed, but that they themselves pose a whole cluster of questions (What are they? How can they be defined or limited?). (Foucault, 1972 [1969]: 26)

In questioning ontologies, my work renders evident the 'cluster of questions' underlying artefacts, subjects, and bodies and problematizes their situated existence in social life. Following sociophilosophy, the role of the sociologist of technology is to interrogate ontologies, dissect rules of intelligibility, and thus question the underlying mechanisms responsible for our understanding of and behaviour in the social world.

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Appendix A: The interview participants

INTERVIEW CODE	SEX	AGE	MOTORCYCLE CATEGORY	GROUP
CR-01	M	56	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-02	M	44	CRUISER	N/A
CR-03	M	54	BMW / DP	BMW MOTOCLUB
CR-04	F	45	CRUISER	N/A
CR-05	M	43	BMW (TOURING)	BMW MOTOCLUB
CR-06	F	44	HARLEY	VIUDAS NEGRAS
CR-07	F	39	CRUISER	VIUDAS NEGRAS
CR-08	F	21	ENDURO	M14, VIUDAS NEGRAS
CR-09	M	50	BMW (MULTIPLE)	BMW MOTOCLUB
CR-10	M	60	ENDURO	N/A
CR-11	M	51	BMW (SPORTSBIKE)	N/A
CR-12	F	53	BMW (CRUISER)	HALCONES
CR-13	M	50	MULTIPLE	MULTIPLE
CR-14	M	46	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-15	M	34	MOTOCROSS	PROFESSIONAL (RET)
CR-16	F	30	CHOPPER	M14, VIUDAS NEGRAS, STEEL ANGELS
CR-17	M	50	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-18	M	36	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-19	F	29	CRUISER	COYOTES
CR-20	M	36	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-21	M	44	HARLEY	STEEL ANGELS, HARLEY OWNER'S GROUP
CR-22	M	51	GOLDWING	N/A
CR-23	F	40	CRUISER	COYOTES
CR-24	M	55	HARLEY	STEEL ANGELS, COYOTES
CR-25	M	54	BMW (DOUBLE PURPOSE)	BMW MOTOCLUB
CR-26	M	56	CRUISER	COYOTES
CR-27	M	51	HARLEY	HARLEY OWNER'S GROUP
CR-28	M	--	SPORTSBIKE	TICO SUPERBIKE
CR-29	M	30	SPORTSBIKE	TICO SUPERBIKE
CR-30	M	--	SPORTSBIKE	TICO SUPERBIKE
CR-31	M	--	SPORTSBIKE	TICO SUPERBIKE
CR-32	F	43	SCOOTER	N/A
CR-33	M	51	SPORT TOURING	ACOMORE
CR-34	M	51	ENDURO	N/A
CR-35	M	45	MESSENGER	N/A
CR-36	M	58	SPORTSBIKE	PROFESSIONAL (RET)

Appendix B: The motorcycles

BMW C (R)1200 Participant(s): 12 Style: Cruiser	
BMW CL (R)1200 Participant(s): 09 Style: Touring	
BMW GS (R)1150 Participant(s): 13 Style: Double-purpose	
BMW GS (R)1200 Participant(s): 01, 03, 17, 18, 25 Style: Double-purpose	
BMW GS Adventure (R)1200 Participant(s): 09, 14, 20 Style: Double-purpose	
BMW RT (R)1200 Participant(s): 05, 09 Style: Touring	

Harley-Davidson Sportster 883 Participant(s): 06, 21, 24 Style: Cruiser	
Harley-Davidson Roadking 1338 Participant(s): 27 Style: Cruiser / Touring	
Honda Goldwing 1832 Participant(s): 22 Style: Touring	
Honda Rebel 250 Participant(s): 04 Style: Cruiser	
Honda Shadow 500 Participant(s): 26 Style: Cruiser	
Honda Shadow 600 Participant(s): 19 Style: Cruiser	

Honda Shadow 1100 Participant(s): 07 Style: Cruiser	
Kawasaki Ninja ZX6R 636 Participant(s): 31 Style: Sportsbike	
KTM Adventure 990 Participant(s): 34 Style: Enduro / Double-purpose	
Kymco Hipster 150 Participant(s): 23 Style: Cruiser	
Moto Guzzi Berva 1100 Participant(s): 02 Style: Sport touring	
Suzuki GSX FE 1400 Participant(s): 33 Style: Sport touring	

Suzuki GSXR 750 Participant(s): 29 Style: Sportsbike	
Suzuki GSXR 1100 Participant(s): 28 Style: Sportsbike	
Suzuki Intruder 800 Participant(s): 16 Style: Cruiser	
Yamaha XT 375 Participant(s): 10 Style: Enduro	
Yamaha YZFR 600 Participant(s): 30 Style: Sportsbike	

Appendix C: Interview protocol

Opening questions

1. Tell me a bit about yourself.
    - How old are you?
    - Tell me about your household. Do you live with anyone?
    - Tell me about some of the things that are important to you.
2. Give me a bit of an overview of your work
    - What do you do for a living?
    - How long have you worked at your job?
    - Why did you choose that work?
    - How much enjoyment do you get out of this work?

The technobiography

3. Tell me how you first got into motorbiking.
    - What was your first biking experience like?
4. What was going on in your life at the time that you started riding?
    - Do you think these **life events** influenced your decision to start riding? How so?
5. How did you **learn how to ride**? Tell me about it.
    - Did you enjoy learning or not?
    - What did you use to learn how to ride?
    - Have you helped anyone else learn to ride? How was that experience?
6. Did your experience of riding **change as you got better** at it? If so, how?

Practice

7. Where does riding a motorbike **fit in** with the rest of you life?
    - How big a part does it play overall?
    - What do you mostly use it for?
    - Do you try to always make motorbikes a part of your life? How?
8. Has it always been this way? Have your **reasons for riding** ever changed?
    - What was going on in your life at the time that these changes happened?
9. Is there **something you get out of riding** a motorbike that you can't get anywhere else in life?
10. Tell me about a **'normal' ride on your bike**.
    - What do you feel?
    - How **fast** do you go?
    - What does the **speed** of the ride feel like?
    - Do you usually ride alone or with others?
11. How much time do you spend doing other things related to the motorbike?
    - For example, cleaning it, repairing it, purchasing parts or accessories, talking to friends about it.
12. When are you happiest in relation to your motorbike? Can you describe those feelings?
    - **What is it that you love about riding a motorbike?**
13. Does your motorbike ever cause you any kind of pain or unhappiness? Can you describe those feelings?
    - How do you deal with these moments?

The machine

14. Tell me about **your bike**.
    Why did you choose to buy the one you did?
    What do you like about it? What don't you like?
    Have you had other ones?
    Have you purchased any accessories?
15. What other **technologies** do you routinely use?
    What kinds of technologies do you have in your home? Are they toys or tools?
    What kinds of technologies do you use in other parts of your life?
16. What is a **'good' bike**? What's not?

Identity

17. What kinds of things make bikers **different** from each other? What kinds of things make them the **same**?
    Do you know any older/younger bikers? Tell me about them.
    Do you know any male/female bikers? Tell me about them.
18. How would you describe **yourself as a biker**?
    How much of that has to do with other parts of your life?
    How much of that has to do with your age, gender, race, class, etc.?
19. How do you think you are seen by others?
    Why do think that they see you this way?
    Do you think that users pay attention to things like your age, gender, race, etc.?
20. Motorbike users have traditionally been **portrayed** as aggressive, hyper-masculine, danger-loving rebels. Do you think that characterization is true?
    Do you know a lot of motorbike riders who fit this category? Describe them to me.
    How many motorbike riders do you know that are very much not like this stereotype? Describe them to me.

Collectives

21. How many friends of yours are motorbike riders?
    How did you meet them?
    How do you all get on?
    Do you see them at other times aside from riding? What sorts of things do you do?
22. What do motorbike users **talk** about? Give me some examples.
    Do you get along with all bikers in the same way? If not, why not?
23. Did you ever belong to any biker **groups or communities**?
    Were the members generally welcoming or not? Did that affect your experience of riding?
24. Do different groups have different identities?
    How did that relate to your individual identity?
25. What makes you **respect** other bikers? What is admirable about a biker?
26. Are there **'alpha-males' in motorbike riding**?
    Describe them to me.
    What brings respect to someone within a group? What makes a group give someone an 'alpha-male' status?
    Where would you say that you fit to these different groups?
    How do these actually work on and off the road?

Appendix D: Thematic indexation

Note: The bracketed numbers indicate the number of representative quotations associated with each secondary or tertiary theme. These are a proxy for, but not an infallible indication of, the preponderance of a theme.

§1 - TECHNOBIOGRAPHY

1. BEGINNINGS
- 1.1 Childhood interest
  - 1.1.1 Friends with bikes [1]
  - 1.1.2 Borrowing bikes from friends [3]
- 1.2 Inherent passion
  - 1.2.1 Been interested in bikes or machines since childhood [8]
  - 1.2.2 Always looking at bikes, hearing them [1]
- 1.3 First experiences during childhood
  - 1.3.1 Feeling of independence, freedom [1]
  - 1.3.2 Feeling of excitement [6]
  - 1.3.3 Negative experience [1]

2. LEARNING
- 2.1 Bicycle as proto-bike
  - 2.1.1 Learning of basic skills [5]
  - 2.1.2 Switch from bicycle to bike as exciting [2]
  - 2.1.3 Use of pedal-bikes [4]
- 2.2 The motorized experience
  - 2.2.1 As a rite of passage [1]
  - 2.2.2 As first contact with engines [1]
- 2.3 Training
  - 2.3.1 Learning by ostension [8]
  - 2.3.2 Learning by experimentation [3]
  - 2.3.3 Learning by participation in sport [1]

3. HISTORY
- 3.1 Changing bikes
  - 3.1.1 Increasing CCs as proficiency [1]
  - 3.1.2 Increasing CCs as growth [4]
  - 3.1.3 Increasing desire to upgrade machine [1]
- 3.2 Bike during youth
  - 3.2.1 As social capital [5]
  - 3.2.2 As expression of youth [1]

4. FATHERS / THE PATRIARCH
- 4.1 Support of father
  - 4.1.1 Father purchased first bike [7]
  - 4.1.2 Father did not support [5]
  - 4.1.3 Father as hero/inspiration [4]
  - 4.1.4 Father as motivator [6]
- 4.2 Challenging the patriarch [4]

5. BIKE AND FAMILY

5.1 In/compatibility of family and bikes
- 5.1.1 Setting up a family, having kids, no bike [9]
- 5.1.2 Bike is not a family artefact [5]
- 5.1.3 Using bike to connect with family [3]
- 5.1.4 Family as firewall [1]

6. BIKE AND RELATIONSHIPS

6.1 Incompatibility
- 6.1.1 Giving up bike for relationship [2]
- 6.1.2 Bike as husband's prerogative [1]
- 6.1.3 Tension [2]

6.2 Compatibility
- 6.2.1 Traveling together on bike [5]
- 6.2.2 Using technology to connect with partner [6]

6.3 Reformulating relationships
- 6.3.1 Getting bike after relationship changes [3]

§2 - RIDING

7. PLEASURE AND THE RIDE

7.1 Uniqueness of experience
- 7.1.1 Indescribable feeling [8]
- 7.1.2 Unique experience [6]

7.2 Emotion
- 8.2.1 Unique emotional experience [2]
- 8.2.2 Serenity [3]
- 8.2.3 Constant emotion [4]

7.3 Pleasure
- 7.3.1 'Pure' pleasure [4]
- 7.3.2 Pleasure of adrenaline [14]
- 7.3.3 Medicinal effect [2]
- 7.3.4 Pleasure in motion [1]
- 7.3.5 Pleasure in skill [1]

7.4 Freedom
- 7.4.1 Generic concept [37]
- 7.4.2 Independence of mobility [3]

7.5 Passion
- 7.5.1 'Pure' passion [3]
- 7.5.2 Like a disease [4]
- 7.5.3 Like insanity [1]
- 7.5.4 Like a drug [5]

8. SENSORIAL EXPERIENCES

8.1 Feeling the environment
- 8.1.1 Smells [5]
- 8.1.2 Temperature [1]

9. NATURE

9.1 Compatibility of riding and environment
- 9.1.1 Displeasure of rain / bad weather [3]
- 9.1.2 Costa Rica as good weather [1]
- 9.1.3 Bike as method to relate to environment [7]
- 9.1.4 Environment-machine compatibility [5]

§5 - MACHINES

25.1.7 User preference [7]
25.1.8 Technological sophistication [7]
25.1.9 Care from the biker [1]
25.1.10 Safety [1]
25.1.11 Design [1]
25.1.12 Speed [4]
25.1.13 Power [3]

§6 - COLLECTIVES

26. COLLECTIVE EXPERIENCES
26.1 Belonging to a group
26.1.1 Pleasure in belonging [7]
26.1.2 Displeasure in mismatch [1]
26.2 Collective rituals
26.2.1 Trip preparation [2]
26.2.2 Eating [2]
26.2.3 Talking about bikes [14]

27. DIFFERENCES
27.1 By bike category [11]
27.2 By clothing [7]
27.3 By riding style [4]
27.4 By group [2]
27.5 By consumption [3]
27.6 By symbols [1]
27.7 By class [9]
27.8 By education [1]
27.9 By age [2]
27.10 By speed [4]
27.11 By norms [7]
27.12 No differences
27.12.1 Bike as unifier [9]
27.12.2 Pan-biker identification [7]

28. COLLECTIVES AND THE SUBJECT
28.1 Influences of group
28.1.1 Conventions, norms, patterns [12]
28.1.2 On driving [12]
28.1.3 On individual identity, identification [12]
28.1.4 On bike [3]
28.1.5 Individual influences group [1]
28.2 Individual response to group
28.2.1 Adaptation [15]
28.2.2 Separation [2]

29. COLLECTIVES AND THE MACHINE
29.1 Influences on machine
29.1.1 Bike category [2]
29.1.2 Preparation of the bike [2]

30. RULES AND REGULATIONS
30.1 Group formations [3]

30.2 Riding protocol
- 30.2.1 Communication [4]
- 30.2.2 Planning [1]

30.3 Membership
- 30.3.1 Membership through participation [1]
- 30.3.2 Membership through procedure [1]

30.4 Superordinated qualities
- 30.4.1 Skill [11]
- 30.4.2 Loyalty [11]
- 30.4.3 Rule-following [6]
- 30.4.4 Respect for others [5]
- 30.4.5 Safety [6]
- 30.4.6 Passion [1]
- 30.4.7 Safety [3]
- 30.4.8 Physical condition [2]
- 30.4.9 Technical support [1]
- 30.4.10 Care for the machine [2]
- 30.4.11 Self-control [2]
- 30.4.12 Knowledge [3]

§7 - GENDER AND SEXUALITY

31. MEN AND BIKES

31.1 Multiplicities
- 31.1.1 The family man, does not ride [4]
- 31.1.2 The single man with freedom [3]
- 31.1.3 The business man, must obey protocols and norms [5]
- 31.1.4 The adolescent, showing off [2]

31.2 Masculinization of bikes
- 31.2.1 Because it is innate [8]
- 31.2.2 Because of social conventions and norms [5]
- 31.2.3 Because of clothing [1]
- 31.2.4 Symbolism [1]

31.3 Masculinization of bike categories
- 31.3.1 Cruisers [3]
- 31.3.2 BMW [1]

32. WOMEN AND BIKES

32.1 Scooters
- 32.1.1 Gendering of scooters as female [5]
- 32.1.2 Less respected than ‘real’ bikes [2]

32.2 Social norms
- 32.2.1 Breaking social norms through riding [6]
- 32.2.2 Freedom from sanctions through riding, empowerment [2]
- 32.2.3 Challenging a masculine space [2]
- 32.3.4 Independent mobility [2]

32.3 Gender identity
- 32.3.1 Riding as challenging female gender identity [1]
- 32.3.2 Visibility as a woman [10]
- 32.3.3 Invisibility because of clothing [2]
- 32.3.4 Derivative of men [1]

32.4 In collectives
- 32.4.1 Marginalized as bad drivers [2]

32.4.2 As sexual decorations for male riders [1]
32.4.3 Belligerency towards women riders [2]
32.4.4 Stereotyping as super-sexual [4]
32.4.5 Need to prove themselves [3]
32.4.6 Certain bahaviour curtailed because of their presence [1]
32.4.7 Different interests [1]
32.4.8 No gender, only skill [2]
32.5 As handicap
32.5.1 Because of established norms [2]
32.5.2 Do not identify with bikes [3]

33. SEXUALITY
33.1 Women and lesbianism
33.1.1 Assumption of homosexuality [4]
33.1.2 Invisibility of the feminine [3]
33.2 Heteronormativity
33.2.1 In self-representations by women [2]
33.2.2 Tropes of heterosexual relationships by men [8]
33.2.3 Bike as part of sexual attraction [3]
33.2.4 Contradiction between family woman and biker woman [1]
33.2.5 Bike as mistress, sexual affair [2]
33.2.6 Organizational structure [1]

§8 - STEREOTYPES

34. COMMON STEREOTYPES
34.1 Hell's Angels [15]
34.2 Messenger bikes [8]
34.3 Death wish [4]
34.4 Criminality [6]
34.5 Easy Rider [1]

35. ENGAGEMENT
35.1 Engaging with the rebel image [5]

36. VISIBILITY / INVISIBILITY
36.1 As a biker
36.1.1 Pleasure in attention [5]
36.1.2 Pleasure in showing off [4]
36.1.3 Pleasure in invisibility [1]
36.2 Making yourself stand out [1]
36.3 Making the bike stand out [2]

37. DANGER
37.1 Dangerous artefact
37.1.1 Intrinsically dangerous [3]
37.1.2 Only perceived as dangerous [4]
37.1.3 Danger as product of action [2]

Appendix E: Underdetermination in technology studies

As a theoretical tool, underdetermination has been developed predominantly within the context of philosophical, sociological, and historical studies of *science*, most probably because of its pre-eminence in the philosophy of science. Within science studies, Quine's thesis (1953 and 1979) had undergone modification in order to remain consistent with the sociological projects that dominated the field during its incipient years. However, even when scientific instruments played a significant role in the sociological or historical narrative, such as with Shapin and Schaffer's study of Boyle, Hobbes, and the air-pump (1989), technology has remained removed from analyses that *explicitly* deploy either underdetermination or finitism.

Despite the absence of overt theorization, underdetermination—or subtle variants of it—can be found in much of the literature on technology. Both in term of empirical case studies and theoretical programmes, underdetermination underlies some key elements in the history, anthropology, and sociology of technology. The lacking component is analytic attention; the questions and the issues are there, but the focus is wanting. As such, it is possible to consider the potential advantages to be gained from a consciously finitist sociology of technology.

Here, I present a review of underdetermination and technology by identifying the various disguises that the thesis presents in the sociology and history of technology. I want to pose and unpack the question: what does underdetermination mean for technology? By addressing the finitism question in relation to technology, I hope to further my continuing project to re-evaluate the applicability of the sociology of knowledge, and in particular the Strong Programme, to technology studies.

E.1 Underdetermined technology: A review

As I note above, underdetermination and finitism have not played explicit roles in the development of technology studies, and neither are to be found as central tenets of a theoretical toolkit employed to discuss the sociality of technological artefacts. However, this by no means implies that underdetermination has not left an indelible mark upon the literature in the history, anthropology, and sociology of technology. Quite the opposite. In a

range of subtle camouflages, underdetermination pervades the STS literature on technology. Having reviewed a selection of work from technology studies, I tentatively identify 6 variations of this subtle influence: material, meaning, usage, normative, political, and boundary underdetermination. I contend that while not explicit instances of underdetermination at work, these instruments of analyses do in fact make use of Quine's underdetermination thesis. Here I address each iteration in turn.

For each facet of underdetermination, I attempt to: provide an overview of the relationship between equivalency and the underdetermined phenomena; justify my claim through a set of key examples from the literature; critically analyze the benefits, implications, and limitations of each facet of underdetermination.

E.1.1 Material underdetermination

In studies of emerging technologies or competing contemporaneous designs, it is possible to identify *material* underdetermination. Vitally, this form of underdetermination concerns the contingency and conventionality of physical mechanisms and structures: the 'hard stuff' of technological artefacts. It is possible to further dissect this form of underdetermination into two sub-categories: first, multiple structural configurations can be designed and constructed to serve the same technological function; second, a single structural configuration can serve a multiplicity of technological functions. In both instances, the emphasis is placed upon the relationship between the physical constitution of the artefact and the artefact's technological function.

Within the philosophy of technology, this form of underdetermination is comprehensively explored by Houkes and Meijers, who notes that there exists:

> … a twofold underdetermination of artefacts: A given function of an artefact can be physically realized in many ways (top-down), whereas a given physical structure can perform many functions (bottom-up). (Houkes & Meijers, 2006: 122)

No clear, *determinate* relationship exists between functions and material construction. Although functions may be curtailed or rendered impossible by some particular structural configuration, no straightforward equivalency exists between the two. Put otherwise, "artefacts and material basis do not have a one-to-one relation." (Houkes & Meijers, 2006: 121).

In sociological and historical studies of technological artefacts, it is also possible to discern the importance of this facet of underdetermination. In their study of bicycle development, Pinch and Bijker examine the various competing designs of the bicycle, as well as the social dynamics that influenced the prevalence of one design over another. Their work empirically illustrates material underdetermination at work. The authors note:

> … there is flexibility in how artefacts are *designed*. There is not just one possible way, or one best way, of designing an artefact (Pinch & Bijker, 1984: 421, emphasis original)

Consequently, all artefacts are materially underdetermined. The Penny-Farthing and the Safety, two competing bicycle models of the time, consisted of significantly distinct structural configurations, despite broadly fulfilling an equivalent technological function.

This category of technological underdetermination highlights both the multiplicity of production and the contingency and conventionality of designer choices. By also problematizing the underdetermination of function by material structures, it lends further credence to my argument that functions are socially-constituted institutions (Schyfter, 2009).

However, by counterpoising function and structural configuration, the analyst runs the danger of essentializing function as an unproblematic phenomenon, and thus eliding its sociality. Furthermore, any investigation of material underdetermination ultimately must grapple with the question of structural equivalency: what makes two designs irreducibly different or sufficiently equivalent? While this rub may set material underdetermination off-course, I believe that valuable use can still be made of the tool's contextualization of function and structure in relation to each other.

In summary: material underdetermination consists either of *functional equivalency and artefact multiplicity* or *artefact equivalency and functional multiplicity*.

E.1.2 Meaning underdetermination

Meaning underdetermination is a central facet of Pinch and Bijker's classic study of bicycle development (1984) and the resultant theoretical framework, known as the Social Construction of Technology (SCOT). Rather than explore the artefact in and of itself, this

approach situates the technology within particular relevant social groups, each of which may attribute a disparate meaning to the artefact. The investigation thus focuses on the social and symbolic associations created by each group in order to assimilate or reject the artefact in question. Consequently, a single artefact may represent a myriad of social meanings for all groups involved in its development, distribution, usage, and rejection.

Pinch and Bijker argue that "different social groups have radically different interpretations of one technological artefact." (1984: 423) In the study, this phenomenon is noted as an exemplar case study of interpretative flexibility (see Collins, 1983); I suggest it is an instance of meaning underdetermination, as meaning attribution and social interpretation are underdetermined by artefact equivalency. For instance, Pinch and Bijker note that among young men, the high-wheeler bicycle was often portrayed as a virile, high-speed machine, while among women and older men, the artefact was interpreted as an unsafe technology, and the meaning of speed was lost. Thus, there existed a multiplicity of machines in the interpretative sense, despite their materialization in a single physical artefact.

Meaning underdetermination is a central element in the SCOT approach, which ultimately aims to examine technological innovation, social uptake, negotiation, and closure; in so doing, it mirrors the EPOR[238] framework assimilated from science studies. Within this project, interpretative flexibility is a major module of analysis, and this form of underdetermination offers the researcher some key insights into technology. Primarily, meaning underdetermination moves social interpretation to the foreground of investigation and analysis, and emphasizes conflict and consensus among varying social groups. In this sense, researchers can gain an understanding of an artefact's underdetermined social situatedness when introduced into social life.

Problematically, meaning underdetermination marginalizes the physical structure of the artefact, robustly highlighted in the case of material underdetermination. While this is not an intractable weakness of this approach, it does force the analyst to carefully avoid subscribing to a perspective that ignores the physical limitations to particular interpretations or the physical contributions that may affect a particular group's attribution of meaning. Vigilance against this form of 'black-boxing' is critical.

[238] Empirical Programme of Relativism, see Collins, 1983.

In summary: meaning underdetermination consists of *artefact equivalency and interpretative multiplicity*.

E.1.3 Usage underdetermination

Above, I note that material underdetermination recognized the multiplicity of technological functions given artefact equivalency. This observation can be reframed in terms of applications and interaction in order to develop a notion of *usage* underdetermination. More than simply the underdetermination of function by physical structure, this aspect of the thesis emphasizes the many possible, irreducible applications that equivalent technological artefacts may satisfy. As such, analyses move from simply noting the social character of technological function in order to incorporate an understanding of technological action as well. That is, more than simply a social concept, usage is also a social action, underdetermined by both the artefact in question and the innovator's intention during the design and manufacturing processes.

In their investigation of the assimilation and transformation of automobiles in rural communities of the United States, Kline and Pinch argue that in order to make automobiles intelligible and legitimate artefacts in these locales, individuals and then communities redefined and appropriated the technology for locally-relevant uses. These applications significantly differed from those of the seemingly cosmopolitan urbanites, motorists who tended to use the rural roads simply for travelling pleasure. Kline and Pinch argue:

> To the urban user the car meant transportation. For the rural user we have identified, the car, as well as being a form of transport, could be a farm tool, a stationary source of power, part of a domestic technology, or perhaps all of these. (Kline & Pinch, 1996: 777)

Though the technological artefacts were equivalent, the use to which they were put by owners in the urban centres and the rural communities were radically different. Kline and Pinch argue that for the rural motorist, transportation did not even comprise the primary application of the technological artefact, as it did for the urban motorist and as it was purposed by the innovators; rather, local applications such as power generation and mechanized farming were the primary applications of the automobile. Thus, no clear determinate link exists between artefact and usage.

Houkes and Meijers similarly argue that oftentimes "the original object ceases to be an artefact of one kind and becomes one of another kind." (Houkes & Meijers, 2006: 126) Such so-called "ontological stacking" occurs when one technological artefact underdetermines a multiplicity of usages. Employing this analytic vocabulary to Kline and Pinch's empirical work, researchers could argue that the automobile displayed "ontological stacking", as the unique artefact was a means of transport, a power generator, and a mechanized farming tool. Employing underdetermination, the analyst could claim that the physical artefact displayed usage underdetermination.

By using this particular analytic tool, it is possible to highlight again the social nature of technological functions, but avoid the essentialism pitfall. Through a sociological analysis of physical practice, community, and function, researchers can identify the development of incipient functions, the fostering of particular technological applications, and the consolidation of communities that reify such usages into established and shared technological practices.

However, this emphasis can also lead to a marginalisation of physical constraints, much as with my earlier consideration of meaning underdetermination. Without proper vigilance against such elision, this form of analysis can come to be concomitant with a vision of 'free-play' and technology function. That is, without a consistent emphasis upon the material constraints limiting usage, researchers can come to subscribe to an over-zealous belief in the multiplicity of possible usages.

In summary: usage underdetermination consists of *artefact equivalency and application multiplicity*.

E.1.4 Normative underdetermination

Normative underdetermination comprises the multiplicity and variation of normative judgements that can be made of any particular technological artefact; when focused on this form of underdetermination, the analyst can examine the manner in which artefact equivalency does not determinately couple with any particular normative judgement of either artefact quality or usage. Furthermore, successful uptake of a particular artefact in any given society does not determine the normative status of the technology when introduced elsewhere or assimilated by different social groups within the same society. Fundamentally,

normative underdetermination is concerned with collectively-established normative judgements, and how these establish particular normative statuses for technological artefacts.

Consider Akrich's study of photoelectric lighting kits developed in France for distribution in Africa. The charitable project under study aimed to provide low-cost lighting solutions for remote communities in Africa; a corporation with experience in photovoltaic technologies was contracted in France to develop the easily-installable kits. While the project was technically a success for the innovators, the end-users of the equipment did not attribute the same normative status to the artefacts. The kits were simply not compatible with local conditions, and thus the users judged them to be badly designed, in stark contrast with the positive consensus reached by the developers of the kits. Akrich writes:

> The industrialists tended to argue that if it didn't work (technically), this was because it had been misused (socially). The users, or those who claimed to be their representatives, argued that if it didn't work socially, this was because it had been misconceived *technically*. (Akrich, 1992: 220, emphasis original)

The point is that artefact equivalency does not guarantee equal normative judgements. These kinds of adjudications are developed in relation to social contingencies and as such require more to explicate them than the artefact in and of itself.

Normative underdetermination allows the analyst to focus on the communitarian basis for normativity, and reframe the problem in terms of conventionality and contingency. Investigations of technological normativity can then look at the manner in which different social groups conceive of an artefact's quality in relation to not only the designers, but also the wider social milieu.

At the same time, this kind of underdetermination risks eliding designers and the innovation process, rendering them both irrelevant to the normativity negotiations that occur at the level of communities of users. While this difficulty can be easily rectified, there is nevertheless a tendency to place too great a weight on the ability of individual users to determine normative quality, and ignore wider influences such as tradition, community demands, and overarching social values.

In summary: normative underdetermination consists of *artefact equivalency and normative judgement multiplicity*.

E.1.5 Political underdetermination

Some of the earliest literature in technology studies addressed the relationship between technological artefacts and politics (e.g. Winner, 1980), and a significant deal of the scholarship since has developed the notion that technology in created, distributed, implemented, and used in particular political manners. Though never robustly expounded or defined, the political nature of artefacts forms a considerable component of research into technology. *Political* underdetermination consists of the suggestion that equivalent artefacts will never enter into determinate political relationships when introduced into any given society. That is, the politics of any technology are seldom predictable, despite any intentions on the part of the innovator. The emergence and implementation of any technology can always result in radically different politics, as both the artefact and its politics develop in relation to specific social conventions and contingencies. Thus, despite artefact equivalency, any given technology may produce disparate or unpredicted political results. Simply put, technological politics are not static, self-contained, determinate, or predictable.

Noble's classic study of automatically-controlled machine tools illustrates the underdetermination of technological politics through a historical sociology of two rival systems: record-playback and numerical control (Noble, 1999). Noble argues that record-playback was favoured by shopfloor workers, as it would necessitate a skilled human operator to instruct the machine whenever a new piece design was required; conversely, management preferred numerical control, as the system could theoretically operate with only data tapes produced by software engineers. Thus, the preferences reflected an ongoing struggle over who possessed leverage within the industry: skilled workers or managerial staff. Despite the implementation of numerical control, the limitations of computational power and the lack of experienced software engineers ultimately did not produce the desired political outcome; namely, the aim on the part of management to de-skill comprehensively its labour force. Rather, the skilled machine tool operator retained a significant deal of leverage due to a continuing need for trained workmanship. Noble's study demonstrates that "[r]eality cannot be extrapolated from the intentions that underlie the technology any more than from the technology itself." (Noble, 1999: 172) The politics of worker-management relations were not decidedly determined despite the character of the implemented technology.

Similarly, Schwartz Cowan (1976) argues that the introduction of domestic technologies such as laundry machines and vacuum cleaners, touted as tools for easing a housewife's workload, instead resulted in an increased demand made upon her time. As such, the designers' intentions, and the artefacts themselves, produced a radically different outcome when incorporated into everyday work:

> … in some cases—notably laundering—time expenditures for old jobs increased because of higher standards. The advantages of mechanization may be somewhat more dubious than they seem at first glance. (Schwartz Cowan 1976: 15)

The sexual politics of the domestic sphere, rather than being challenged by new technologies, were instead further emboldened and reified. This is more than simply a negation of technological promises and future expectations. Instead, it is a facet of technological underdetermination, linked not so much with the artefact itself as with the social milieu within which it develops and operates.

Political underdetermination highlights the variability of consequences, societal arrangements, and implications from technological development and implementation. It shifts the focus from the artefact to the interaction between collectives and technology and the dynamic processes of negotiation and consensus. Importantly, by understanding technological politics as inherently underdetermined, the analyst can avoid the trap of essentialism when considering the 'internal' politics of an object.

Ultimately, however, technological politics is a difficult concept to discuss in relation to underdetermination. Because the notion of 'technological politics' is nebulously applied in much of the literature, it becomes difficult to identify what exactly is being underdetermined. When employing this tool it becomes crucial to specify in what manner politics interact with technological artefacts.

In summary: political underdetermination consists of *artefact equivalency and multiplicity of political arrangements, consequences, and implications*.

E.1.6 Boundary underdetermination[239]

[239] I am indebted to Juan-Pablo Pardo-Guerra for suggesting the possibility of boundary underdetermination.

Finally, it is possible to discuss the manner in which different communities and individuals construe the limits that both physically and ontologically define a technological artefact, and the conventionality and contingency of these definitions. Put otherwise, the analyst can examine the different delimitations constructed by communities that define the integrity of any technological artefact vis-à-vis objects that are liminally associated and entirely disconnected. This *boundary* underdetermination, possibly also construed as *systemic* underdetermination, is of crucial import when researching components of large technological systems, or when investigating the relationship between a particular artefact and its 'satellite' technologies.

An artefact is never limited to itself. Rather, it is constituted and conceptualized within a broader cluster of artefacts, and is oftentimes in a direct operational relationship with other technologies. While this approach is most commonly associated with Actor-Network Theory (Callon, 1986) or more postmodernist approaches to technology (Law, 2002), I believe that it in fact represents a clear instance of underdetermination, and is congruent with a finitist approach to technology. As I note above, a central tenet of finitism under the Strong Programme is the interconnected character of terms and concepts (Barnes, 1982; Barnes, Bloor, & Henry, 1996); here, there exists a similar dependency between artefacts and specifically, the ontological construction of artefacts. Furthermore, the artefact itself, and even the other artefacts within the possible locus of interconnections, does not conclusively determine how a technology is situated in relation to other artefacts, or how the boundaries of that particular technology are defined by the community of users.

Hughes' investigation of so-called 'sociotechnical systems' (1998) illustrates the relationship between a complex of multiple artefacts operating within a given heterogeneous social milieu. In examining an electrical light bulb, the distinction between that object and the socket, the electrical wires, switches, cables, and the myriad of technologies involved in the process of power generation is by no means clear-cut, as the initial technology under examination depends on a vast array of other technologies in order to operate. That is:

> An artifact—either physical or nonphysical—functioning as a component in a system interacts with other artifacts, all of which contribute directly or through other components to the common system goal. (Hughes, 1998: 202)

In this sense, individual system components, unique artefacts, jointly constitute the overall system, and thus effectively shape the contour of this system. Concurrently, "[b]ecause

components of a technological system interact, their characteristics derive from the system." (Hughes, 1998: 203) That is, unique artefacts are often shaped both physically and ontologically by the constellation of technologies with which they interact, and through which their function is realized.

Boundary or systemic underdetermination places a great deal of emphasis upon contextuality and relationality. However, it does so in a manner different from the other forms above, which drew upon notions of *social* conventionality and contextuality. This form of underdetermination instead situates the artefact within a system of interaction composed of other technological artefacts, and thus brings to the fore *artefact* contextuality and relationality, hitherto lacking as an analytic consideration. Moreover, boundary underdetermination can highlight macro-level considerations, such as those associated with Hughes' sociotechnical systems (1998), which moves the focus from lower-level interactions to wider, societal phenomena.

Clearly, this does come at the cost of possibly eliding the micro- and meso-level analyses, which are crucial when exploring the relationships between technologies and localized communities within any given society. However, with proper consideration the analyst can avoid reifying macro-level observations as representative of lower-level dynamics. Furthermore, any analysis must carefully avoid losing sight of the specific artefact in question amongst the myriad of other objects it relates to. Ultimately, it is this artefact that must receive the fullest and primary attention.

In summary: boundary underdetermination consists of *artefact equivalency and multiplicity of physical and ontological integrity*.

E.1.7 Taking stock

By assiduously parsing underdetermination into a piecemeal theoretical toolkit rather than a single concept, I have been able to identify the mobilization of underdetermination within technology studies, albeit without its explicit usage. More than simply illustrating the presence of underdetermination within technology studies, this exercise reveals a great deal about the thesis itself, as well as how it has been and can be deployed in the study of technological artefacts.

I identify the malleability of underdetermination in relation to technological artefacts; more precisely, I deconstruct the thesis into a variety of applications, and made specific an otherwise too-broad analytic tool. While underdetermination can be a functional and effective theoretical tool within technology studies, its use must be deliberately specific. The researcher must have a clear understanding of what form of underdetermination is under examination in any particular facet of a study, and must utilize the set of tools in such a way as to emphasize that aspect to the exclusion of the others. Succinctly put, underdetermination in technology studies is an array of tools and analytic lenses, rather than a single all-encompassing framework. For instance, should analyses focus on physical practice and applications, the researcher might choose to elide boundary underdetermination in favour of usage or material underdetermination.

It is precisely because of this malleability and multiplicity of applications that underdetermination comprises a useful, versatile lens, and can aid in the development of the field. I have above identified the discontinuities that exist between equivalencies and multiplicities. In the case of Quine applied to science studies, the work of the Strong Programme suggests that the missing links include factors such as tradition and shared paradigms. Put otherwise, social phenomena fill the gaps left open by empirical equivalency. Similarly, it is possible to utilize the notion of underdetermination to analyse the relationship between spatio-temporal entities, the objects we refer to as technological artefacts, and the manner in which these artefacts operate within social life.

E.2 The finitist artefact: Future work

I intend to further explore the ramifications of an underdetermination analysis within technology studies by mobilizing the notion of finitism, taken originally from Wittgenstein and applied sociologically by the developers of the Strong Programme in the sociology of scientific knowledge (Barnes, Bloor, & Henry, 1996; Bloor, 1997b). I believe that a finitist sociology, implemented in order to address the nature of technological artefacts, can accomplish a series of important goals.

Underdetermination can be used in a manner congruent with sociological research. That is, researchers can move from Quine's philosophy to the Strong Programme's sociology without losing the central tenets of underdetermination and gaining the ability to engage in philosophically-informed sociological research.

The Strong Programme can be further developed vis-à-vis technological artefacts, a project I began by examining the applicability of the Performative Theory of Social Institutions to the questions of technological ontology, function, and normativity (Schyfter, 2009). More comprehensively addressing underdetermination is a crucial next step.

A necessary first step in the direction of these important questions was the present review of underdetermination and technology studies. These pending enquiries, along with a further analysis of finitism, will comprise the topic of future work with the Strong Programme and artefacts.