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Misinformation on the Internet?:

A Study of Vaccine Safety Beliefs

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Information Studies

by

Colin C. Doty

2015

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ABSTRACT OF THE DISSERTATION

Misinformation on the Internet?:

A Study of Vaccine Safety Beliefs

by

Colin C. Doty

Doctor of Philosophy in Information Studies

University of California, Los Angeles, 2015

Professor Leah A. Lievrouw, Chair

Concerns about misinformation on the Internet usually focus on the amount of misinformation available, the ease of retrieving it, the speed with which it spreads, or the lack of editorial oversight. Yet none of these would be cause for concern if no one was misinformed. Indeed, what constitutes misinformation is often determined by who believes it. Hence the most important consideration may be a focus on why people believe. To explore this, this study reports results from a qualitative content analysis of online information about vaccine safety—with a particular focus on user comments—supplemented by exploratory interviews. The study examines how people on all sides of the debate use evidence to support their beliefs about vaccine safety. It also reflects upon the relationship between the Internet and those beliefs.

The most common beliefs about vaccine safety are beliefs about toxicity, beliefs about the cumulative effects of vaccines, beliefs about the premise of immunization, and beliefs about the compromised integrity of the medical system. Contrary to popular conceptions, these beliefs do not divide easily into binaries of pro-vaccination and anti-vaccination. Rather, it is as if

available beliefs were arrayed in a buffet from which each believer chooses an individualized meal. The selection of beliefs is limited, as the same beliefs recur over and over in the data, yet each believer combines the limited selections into diverse belief profiles.

People justify these beliefs using risk-benefit calculations based in reason and authority, both of which are heavily influenced by personal experience, a kind of evidence that may be more prominent on the Internet than elsewhere. These basic tactics are employed in complex patterns that vary across beliefs, believers and situations. Perhaps surprisingly, while each person uses the tactics in different ways and to different degrees, the same basic tactics are used on all sides of the vaccine safety debate, suggesting a more complicated belief landscape than the popular conception. In turn, this suggests that it is not merely that misinformation affects what we believe, but also that what we believe appears to affect how we understand misinformation.

The dissertation of Colin C. Doty is approved.

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University of California, Los Angeles

2015

Dedication

This dissertation is dedicated to my father, who died during the second year of my doctoral coursework. After a long career as a business executive, he had semi-retired and was teaching management courses at various colleges. This project is therefore the culmination of a long journey toward his legacy as Professor Doty.

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CHAPTER ONE

INTRODUCTION

Overview

There is a popular perception that the emergence of the Internet has resulted in a corresponding rise in misinformation and fringe belief, presumably because the ease with which information can be created, transmitted and accessed has led to an increase in unvetted, questionable, or outright false information. But this assumption, that an increase in the number of information producers leads to an increase in misinformation, may misleadingly overlook the role of the information consumer, for what would be the harm of misinformation if no one believed it? To explore this, this study examines how specific users use evidence to support their beliefs. Which evidence do evaluators cite, which do they accept, which do they reject, and what are their reasons for doing so?

This study focuses on the controversy over vaccine safety, investigating people's beliefs about whether to vaccinate or not. Importantly, vaccine safety is a controversy about science, a knowledge system that relies on evidence and is explicit about how it relies on evidence, yet its techniques and reliability have been debated. Indeed, while the scientific consensus suggests that vaccines are safe, a significant number of people nonetheless remain unconvinced by the science.

Problem and General Context

On the Internet, anyone, regardless of credentials, motives, or honesty, can publish information to (potentially) the entire world. Likewise, the Internet is increasingly replacing other media and information sources, including interpersonal ones (Case, 2007), especially for health information (Case; Warner & Procaccino, 2004). Intuitively, it seems as though this should result in more misinformation, spreading more quickly. Indeed, false rumors have been

known to spread virally through platforms such as Twitter before they are ultimately corrected (Atlani-Duault, Mercier, Rousseau, Guyot & Moatti, 2015; Peters, 2012; Starbird, Maddock, Orand, Achterman & Mason, 2014). To the extent that the Internet may be unique in the production of misinformation, the popular belief seems to be that the reason for this is that the Internet enables the “prosumer,” i.e., every information consumer is also a potential producer.

The first problem caused by the prosumer Internet is one of information production and distribution. Since anyone can produce information quickly and easily, a great deal of information on the Internet is produced by amateurs who may lack the credentials, expertise, or even desire to properly verify the information they create (Metzger, Flanagin & Zwarun, 2003; Rieh & Hilligoss, 2008), and who operate free of editorial oversight or quality control (Floridi, 1996; Hitlin, 2003; Katz, 1998; Keen, 2006; Lewandowsky, Ecker, Seifert, Schwarz & Cook, 2012; Metzger, 2007; Rieh, 2002; Rieh & Danielson, 2007; Swinnen, McCluskey & Francken, 2005). This is exacerbated by the ease of sharing on the Internet. Anything consumed can rapidly be reproduced and propagated, which seems to result in a more rapid spread of misinformation than was previously possible (Atlani-Duault et al., 2015; Hitlin; Kareklas, Muehling & Weber, 2015; Katz; Kelly, 1997; World Economic Forum, 2013).

The second misinformation problem is one of consumption. On the Internet, anyone can search for information and retrieve it, regardless of their information skills (Metzger, 2007; Metzger, Flanagin & Medders, 2010; Metzger et al., 2003; Rieh & Danielson, 2007). There is so much information online that consumers may lack the time, skills, or desire to tell good information from bad (Case, 2007). Search engines may also “prioritize information differently than an expert reviewer or editor might do” (Atlani-Duault et al., 2015, p. 54-55). Two other such explanations are, interestingly, contradictory. The more positive model proposes that the

ease of access to Internet information will make verification easier than ever before (Floridi, 1996; World Economic Forum, 2013). In this model, the Internet would make people less misinformed than, for example, the mass media, which was, prior to the Internet, more difficult to verify. The opposing model is the bubble or echo chamber model, in which consumers so narrowly tailor their information consumption through filtering and personalization that they never encounter information that challenges or contradicts what they already believe (Floridi; Pariser, 2011; Sunstein, 2007; World Economic Forum). Hence in this model the Internet makes us more misinformed. These contradictory claims that the Internet makes misinformation both better and worse underscore the danger of monolithic, technologically deterministic explanations of the behavior of the Internet, as opposed to the individualized experience of any particular Internet user.

Despite their opposite conclusions about Internet misinformation, these two models share a common assumption, that misinformation can be countered by opposing evidence. There is much evidence to suggest the opposite, however, including findings that opposing evidence is ignored or resisted (Kuklinski, Quirk, Jerit, Schwieder & Rich, 2000; Lewandowsky et al., 2012) and may even strengthen the original belief (Nyhan & Reifler, 2010). This exposes a further, deeper assumption that information consumers form beliefs by rationally evaluating evidence. For certain beliefs, this may very well be true, but it is also rather obvious that emotional, psychological, social, political, moral and experiential factors complicate the criteria upon which we base our beliefs and the presumed-to-be rational process by which we form them (Metzger et al. 2010; Rieh & Hilligoss, 2008).

Hence the key to understanding misinformation may not be a focus on its production or its dissemination, but rather on how and why it is believed. It may or may not be true that we are

producing more misinformation than ever. This may or may not result from the ease of its production and access, the rising number of producers, the lack of traditional gatekeepers, the speed of production and dissemination, or from the echo chamber of personalization filters. But if no one believes the misinformation then no one is misinformed, and hence of what consequence is it? It is reasonable to consider that while the Internet may have changed how we produce information, how we search for it, and even what evidence we find, it may not have changed what we believe and why.

There is also a compelling epistemological reason to understand misinformation by focusing on belief. “Misinformation” is most simply defined as false information, and “misinforming” as creating false knowledge, or belief in something that is not true (Fallis, 2009; Fetzer, 2004; Fox, 1983). Such definitions therefore rely upon a truth that is knowable and objective, rather than relative or socially constructed (Berger & Luckmann, 1967; Fallis, 2006; Sherratt, 2006; Stahl, 2006). Yet who has the authority to say what is misinformation and what is not? In some sense, the question "why do people believe misinformation?" is really "why do people believe something other than what I believe?" Thus, the best way to approach the study of misinformation may not be to determine what is true and what is false, but rather what is believed and what is not, and more importantly, why. As a research question and a subject of empirical study, therefore, this study does not focus on the quality of evidence or its correspondence to reality, but rather on why people believe that something is true.

Beliefs in the truth of a claim are formed, fundamentally, from the evaluation of evidence. This is often modeled as a rational, linear process. Ford (2004), for example, describes information seeking using Popper’s concept of error elimination. This model envisions an information seeker as “constantly generating, testing and modifying theories” (p. 772). The

seeker in a state of uncertainty forms a tentative theory, considers evidence in order to determine how well the theory addresses the uncertainty, and then revises the theory accordingly. But as Haidt (2001) argues, linear reasoning is only one kind of cognition. While some humans may like to attribute their beliefs to rationality, Haidt shows how intuition, in particular, heavily influences beliefs. These intuitions are rooted in emotions, biases, previous experiences and motivations in ways that are not always rational or linear (Haidt; Lewandowsky et al., 2012; Slovic, Finucane, Peters & MacGregor, 2004). Despite this, people usually prefer to support their beliefs with some evidence, especially when defending them against disagreement. If beliefs are based upon evidence, and evaluations of evidence are not always purely rational, then how do people evaluate the information upon which they base particular beliefs? What evidence do they rely upon? Which evidence do they accept and which do they reject? What are their reasons for accepting or rejecting any particular evidence?

To get the best understanding of this, this study focuses on controversial beliefs where adherents on each side of the issue can accuse each other of being misinformed. For this reason, this study seeks to understand belief on opposing sides of a controversial issue, where evaluators may encounter evidence that is contradictory.

The Case of Vaccine Safety Beliefs

A fruitful place to begin to answer these questions is to investigate controversies about science, particularly where the scientific consensus is strong and yet some hold beliefs in direct contradiction to it. As a case for studying evidence, science has the advantages of being a knowledge culture that explicitly relies on (empirical) evidence, has explicit rules for evaluating that evidence, and on the basis of these premises contends that its knowledge claims are uniquely

reliable. At the same time, the techniques and reliability of science have been widely debated (Van House, 2004).

Hence this study focuses on the controversy over vaccine safety, investigating why people believe that vaccines are safe or unsafe. While the scientific consensus suggests that vaccines are safe (Maglione et al., 2014), a significant number of people nonetheless remain unconvinced, and each side of the debate accuses the other of spreading misinformation. At the same time, vaccines have enormous public health consequences, particularly in the face of the recent decline in vaccination rates (Baum, 2014; Lin & Poindexter, 2009; Mohajer & Kumar, 2011) and recent outbreaks of vaccine-preventable diseases (California Department of Public Health, 2015).

Importantly, this is not a study of belief generally, but of a particular kind of belief in a particular kind of environment. Vaccine safety beliefs are different from other kinds of beliefs, such as religious beliefs, moral beliefs, or even beliefs in other factual claims. Specifically, vaccine safety is a topic about which many are considered to be misinformed, and about which many disagree. At the same time, the controversy is unevenly balanced, with one clear consensus view and a passionate minority that rejects that consensus. This makes it an ideal case for studying belief in misinformation.

In addition, the vaccine safety controversy has particular advantages as a means of studying misinformation on the Internet specifically. Kata (2010) has found that anti-vaccination content is more common on the Internet than elsewhere, that people doubting vaccines are more likely to use the Internet, and that the websites they use often misrepresent or omit medical research. Betsch (2011) has found that the Internet can be particularly influential on beliefs about vaccination, that it exaggerates anti-vaccination information compared to the scientific

consensus, and that anti-vaccine information is very easy to find. Kareklas et al. (2015) similarly found that online comments about vaccine safety could, under certain conditions, influence belief more than the article upon which they commented. Venkatraman, Kumar and Garg (2015) found that “greater freedom of speech (sites like YouTube and Google) correlated with anti-vaccine views” (p. 1424). On the other hand, McRee, Reiter and Brewer (2012) found that parents accessing information on the Internet about the HPV vaccine had higher knowledge and more vaccine positive beliefs. Hence there is reason to believe that vaccine safety beliefs may be uniquely influenced by the Internet.

Similarly, misinformation itself may have enormous consequences beyond the narrow issue of vaccine safety, from misinformed health decisions to misinformed political decisions to misinformed personal interaction. Therefore, to the extent that insight about vaccine safety beliefs might generalize to the broader concept of misinformation, this study may enrich our understanding of misinformation, how it occurs, how serious it is, and what might be done about it.

The case of vaccine safety beliefs offers insights not only into what people believe, but also how they believe it. In navigating the basic risk versus benefit calculus of vaccine safety, people attribute their beliefs to reason and rely upon trusted authorities and their own experience. This appears to be the case regardless of their ultimate beliefs about vaccine safety, as both pro-vaccination and anti-vaccination beliefs are justified using similar tactics. Beliefs about vaccine safety rely upon beliefs about what is misinformation and what is not, ultimately suggesting that misinformation influences belief and, in turn, belief influences the evaluation of misinformation.

CHAPTER TWO

BACKGROUND

The background for this study begins with an exploration of the epistemology and ontology of misinformation in order to understand the nature of the concept. Related to this inquiry is a consideration of theories of evidence from the scientific, legal, historical and archival arenas. The study also draws upon both psychological and sociological theories of belief in misinformation, including bias, selective exposure, social influence and social embeddedness. Lastly, the criteria by which evidence might be evaluated can be drawn from the literature of information literacy and information quality which investigate such factors as accuracy, authority, credibility, trust and authenticity.

Information and Misinformation

What is misinformation, as a general concept? Most scholars define it as information that is “false, mistaken or misleading” (Fetzer, 2004, p. 231), inaccurate (Fallis, 2009), or as otherwise fundamentally requiring falsity (Fox, 1983). Yet such a definition immediately meets with difficulties.

The first, though perhaps less important, difficulty is that this definition depends on particular conceptions of the underlying concept of information itself. To begin with, it relies upon definitions that emphasize the relationship between information and knowledge (Brookes, 1980; Buckland, 1991; Case, 2007) rather than those which distinguish kinds of information with no relationship to knowledge (Bates, 2005; Buckland). More significantly, this definition of misinformation contradicts definitions which assert that information must be true in order to create knowledge (Dretske, 1981; Grice, 1989). In other words, a false belief is not knowledge and therefore that which creates true belief (information) must be distinct from that which creates false belief (misinformation.) By this conception, misinformation is not information; it is the

opposite of information. This definition would limit certain analyses of misinformation, however, because it implies that conclusions about information may not follow about misinformation. A better concept might be a kind of subset model where misinformation is a portion of all information, rather than a separate entity (Case, 2007; Fox, 1983). This depends on a definition of information that does not require that it be true, for only if some information can be false can misinformation qualify as a subset of it. Fortunately, Fox, among other scholars (Fetzer, 2004), offers a convincing case that information does not require truth. This enables a subset model that allows us to consider all models of information as potentially applicable to misinformation, regardless of whether they address misinformation explicitly.¹

A more significant complication of defining misinformation as false information has to do with varying conceptions of truth. If misinformation is false information, then the identification of truth is essential to the identification of misinformation. The difficulties with identifying truth are much debated (Sherratt, 2006; Van House, 2004). Stahl (2006) points out that defining misinformation as incorrect information requires a correspondence theory of truth. If, however, the truth is socially constructed, as many have argued (Berger & Luckmann, 1967; Fallis, 2006; Sherratt; Van House), it follows that misinformation is socially constructed as well (Karlova & Lee, 2011). Stahl applies the ideas of Foucault and Habermas to defining misinformation, noting that since there is disagreement as to what constitutes truth, it follows that there is disagreement as to what constitutes misinformation. Every commitment to a particular conception of misinformation, therefore, represents a value judgment on the part of the researcher. This is even more problematic given that most of our experience is second hand, and

¹ Similar considerations surround the distinction between misinformation and disinformation, as sometimes disinformation is considered to be intentional misinformation (Fetzer, 2004; Fallis, 2009), and sometimes the two are considered synonymous or are not distinguished (Floridi, 1996). While these distinctions are important, they are properties of the production of information, and hence are of minor relevance to the present focus on the consumption of information.

our determination of truth and falsity usually depends in part on the evaluations of others, meaning that most of us evaluate misinformation not by evaluating the information itself, but rather by evaluating those who evaluate for us and the criteria by which they evaluate it (Fallis, 2006, 2008; Van House). To decide, for example, that scientific consensus is correct is to decide that scientists (at least, in aggregate) are trustworthy and that their methods are reliable. It usually does not mean that we ourselves have conducted studies to verify the consensus. This suggests that the naming of anything *as* misinformation is open to debate, and does not consist of what is empirically true or false, but rather “what is collectively endorsed,” (Fallis, 2006, quoting Bloor; Van House) according to dominant discourse and power structures (Berger & Luckmann; Sherratt; Stahl.) Who gets to say what is true or false, what is correct or incorrect, what is misinformation or not? On numerous controversial issues – vaccine safety among them – each side of the debate claims that the other side is spreading misinformation. To identify any particular thing as misinformation is to privilege one set of criteria for truth evaluation over another. Hence there is an important sense in which misinformation is in the eye of the beholder.²

In another sense, however, such a definition seems illogical. Not all propositions can be equally true according to who chooses to believe them. Indeed, it is probably not very useful to treat all truth claims as equally valid, particularly for social scientists attempting to describe life as it is actually lived, since human beings simply do not behave as if all truths are equally likely. We operate, for example, as if the law of gravity on Earth is true, enough so that it would not be a good idea to leap from tall buildings. Likewise, it cannot be true both that the sun goes around the earth and the earth around the sun. It probably overstates the case, therefore, to conclude that

² This is not the same as saying that misinformation is a matter of opinion, for it professes to be neither a moral judgment nor an aesthetic one. Rather, the concept of misinformation seems to suggest an empirical judgment. In other words, saying that “Hamlet” is a bad play or that murder is good are not misinformation.

the social construction of knowledge means that no knowledge is better than any other (MacNeil, 2001). As Van House notes, rather than total relativism, it is better to recognize that any understanding of truth could have been different, without asserting that scientific knowledge is “nothing but rhetorical” (p. 31).

In some ways, constructivism and subjectivism may even help to explain misinformation, because over-reliance on one’s subjective understanding and one’s own interpretation may be among the causes of misinformed belief. It is interesting to note that the literature of constructivist epistemologies (Van House, 2004; Sherratt, 2006; Stahl, 2006) and the literature about causes of misinformation (Kuklinski et al., 2000; Lewandowsky et al., 2012; Nyhan & Reifler, 2010) identify many of the same factors, including bias, error, power, and discourse. Even Bruno Latour, a famous advocate of constructivist views of knowledge, finds himself troubled by how criticisms of the production of scientific knowledge may have opened the door for climate change denial and 9/11 conspiracy theories (Latour, 2004). Where Latour once combated “excessive confidence in ideological arguments posturing as matters of fact,” he finds himself concerned about

excessive *distrust* of good matters of fact disguised as bad ideological biases...

While we spent years trying to detect the real prejudices hidden behind the appearance of objective statements, do we now have to reveal the real objective and incontrovertible facts hidden behind the *illusion* of prejudices? (Latour, 2004, p. 227, emphasis in original).

Indeed, it would be disconcerting to adopt an epistemological stance in which conspiracy theorists are as likely to be correct as scientific consensus.

It would appear, therefore, that neither a fully objective definition of misinformation (“incorrect information”) nor a fully subjective one (“misinformation is in the eye of the beholder”) will suffice. A more appropriate, or at least useful, definition lies between these two extremes. Some thinkers, therefore, mediate the constructivist objections to the truth condition by distinguishing between the existence of truth and our ability to know it with certainty (Fallis, 2006; Furner, 2004). According to this argument, while there is such a thing as objective reality, at least in some areas, there is no such thing as objective knowledge, since discourse and power interfere with our ability to know reality for certain.

Still, some truths seem immensely more likely than others. Rather than thinking of our truth claims objectively, therefore, we might think of them as probabilities based on evidence and the consequences of treating them as if they are true (MacNeil, 2000, 2001). MacNeil and Mak (2007) suggest that “[t]he truth of any proposition is based on reasoning from the relevant evidence and measured, not in terms of absolute certainty, but rather in terms of probabilities, which will always be a matter of degree” (p. 39). We refrain from leaping from buildings because the law of gravity seems extremely likely to be true, partly due to its consistency in past observations, while we also understand certain circumstances in which gravity does not apply in the same way. At the same time, the truth of natural laws may be more empirical than the “truth” of human behavior, and thus our understanding of misinformation must be cautious from two directions: both with an awareness of the social context of truth evaluation and of the ambiguous reality of social behavior.

Defining misinformation based merely on its truth or falsity also fails to fully account for concerns about it. To the extent that misinformation is considered a problem, that concern depends on its potential to misinform. By this definition, misinformation can be considered that

which creates false belief (Fox, 1983). This relies on the fundamental definition of misinformation as false information, but extends it to emphasize the consequences. Consider, for example, the proposition “the moon is made of green cheese.” By most definitions, this qualifies as misinformation because it is not true. However, few if any people actually believe that it is true, so it does not misinform. Those who lament an alleged increase in misinformation are presumably concerned not about misinformation per se but about people being misinformed. Hence, defining misinformation merely as false information without accounting for its potential consequences is insufficient for understanding concerns about misinformation, including the relationship between misinformation and the Internet. To lament misinformation as a problem is not merely to lament the existence of incorrect information, but also to lament the existence of incorrect belief.

Belief

In the end, misinformation probably by definition cannot exist without there being some truth for it to contradict. It is certainly difficult to define without some allowance for correspondence theories of truth. But we can address this restriction without having to verify any truth claims ourselves by focusing on how individuals make their own decisions about the truth. This study does not aim to determine which beliefs are wrong or right, to resolve controversy or to determine whether vaccines are safe or dangerous. Rather, the intention is to explore individual truth evaluations and their relationship to beliefs. This may make it unnecessary to strictly operationalize misinformation for this study, but the focus on belief certainly favors a conception of misinformation as that which creates false belief. No matter who is wrong or right, and whether misinformation is entirely objective or entirely constructed, we can still study belief in it.

But how are we to understand belief? Gilbert (1991) writes, “Beliefs, in the broad and colloquial sense, involve both the *mental representation* and the *positive assessment* of meaningful information” (p. 107, italics in original). As Haidt (2001) has argued, a mental representation need not imply rationality, nor even that the representation originates in the brain, but a more complex experience of impressions, intuitions, and other factors including but not limited to thinking or reasoning. Nor is the representation necessarily a final decision, as even Gilbert notes, but may be subject to revision. It does seem nonsensical, however, to speak of someone believing something about which they have no mental representation, in whatever form or to whatever degree. More importantly, to qualify as belief by Gilbert’s definition, this representation must include a positive assessment. By positive, Gilbert appears to mean that the mental representation “is treated as if it was true” (p. 107). Hence something one has assessed to be false, or about which one has formed no impression, is not something one believes. This puts the emphasis on the assessment, and in particular on how one makes an assessment that is positive.

Assessment again need not necessarily imply either a linear or a rational process, but merely something like a judgment, evaluation or impression. It would also seem to be more robust than a wild guess. The assessment appears to rely, therefore, upon some criteria by which some set of things is determined to be more useful to the assessment—more relevant, more important, more convincing, or whatever—than some other set of things. The criteria for that assessment—the things considered in determining whether the assessment is positive or negative—is often called evidence. But what exactly is evidence? In particular, how do people try to determine what constitutes “good” evidence?

Evidence

Theories of evidence from the archival, legal, historical and scientific arenas vary (Furner, 2004; MacNeil, 2000), and although this study focuses on conclusions drawn from scientific evidence, it has been informed by all of those concepts of evidence to the extent that any of them may elaborate the strengths or weaknesses of the others.

Three kinds of evidence are relevant to this study: that which scientists consult, that which the subjects of the study consult, and that which we as researchers consult. The first kind, the scientific evidence itself, consists of what the scientists study in order to draw conclusions about vaccine safety, including experimental data in laboratories, epidemiological data, and the like. The evidence that subjects of the study consult – found on the Internet and elsewhere – consists of evidence *about* the science and evidence of personal experiences with vaccine safety. Evidence about the science is notably not the scientific evidence itself, but rather descriptions of it at one level of remove. Evidence of personal experiences consists either of firsthand experience with one's own child, or of anecdotal experience about another person's child. The third kind of evidence, the kind collected for this study, is evidence about people's beliefs and evaluations. While the study does not focus on how this third kind of evidence is evaluated, it is worth noting that it is nonetheless evidence being evaluated, and hence the epistemological concerns we may have about evidence evaluation apply not only to the evidence that is the subject of the study, but also to the study itself. It is also worth noting that the Internet is constructed by humans and thus the evidence there is constructed. The Internet itself contains little if any primary, direct evidence of vaccine safety. However, it does contain direct and indirect evidence of belief and evaluation, and it is the latter that is the subject of this study.

Much like definitions of misinformation, definitions of evidence begin with positivist conceptions. Duranti (1998), writing specifically about documentary evidence, defines evidence as the “source of proof of facts that needed to be demonstrated” (p. 5), and as “a relationship between a fact to be proven and the fact that proves it” (p. 6). MacNeil (2000) describes the concept of “evidence as inference” in which evidence is a sign or trace of an external reality. Furner (2004) softens the concept to allow more subjectivity by defining evidence as “that which we consider or interpret in order to draw or infer a conclusion” (p. 247). Evidence is therefore a kind of justification of belief, which classical epistemology considers an essential component of knowledge (Fallis, 2006; Furner, 2010).

All of these definitions suggest some sort of cause and effect relationship between the evidence and that proposition that the evidence purports to “prove.” In other words, if proposition p would result in evidence e , then our observation of evidence e suggests the truth of proposition p , and the lack of evidence e suggests (to whatever degree), the falsity of proposition p . The exact relationship between the evidence and the proposition it proves depends on the kind of proposition at issue. Legal, historical and archival evidence, for example, all seek to prove historical events using as evidence the results of those events (Furner, 2004; MacNeil, 2000). For example, a document may be evidence to a jury, historian or archivist that a certain transaction has taken place (see also Duranti, 1998). Scientific evidence, however, often has different aims. While it may seek to prove historical events, such as biological evolution, science also uses evidence predictively, to assess, for example, whether it will rain tomorrow, or how a vaccine may affect a child. Science is therefore unique in using evidence to assess cause and effect relationships, such as the relationship between clouds and rain, or between vaccines

and autism. This is a more complex standard of evidence, since probably even a strict positivist would not argue that the future can be known with certainty.

Importantly, not even the fields specializing in historical evidence (lawyers, historians and archivists) assert that evidence is conclusive proof of an external reality. Rather, evidence is conceived in terms of probabilities, such that our inference about a particular proposition comes from our assessing the likelihood of one fact in light of another fact, i.e. our assessing the likelihood of a proposition in light of evidence (Furner, 2004; MacNeil, 2000, 2001; MacNeil & Mak, 2007). As Furner describes this use of evidence by scientists, “we calculate the effect of observed evidence on our degree of belief in a hypothesis” and conclude that the evidence confirms the hypothesis to the extent that it increases belief (p.238). Notably, this description characterizes evidence in terms of belief rather than truth. It is possible, of course, that evidence could increase someone’s belief in a proposition without increasing the likelihood that it is objectively true. Furthermore, beliefs can obviously be incorrect, while empirical truth by definition cannot be. Indeed, Furner himself characterizes beliefs in terms of “personal evaluations” and “preferential attitudes” rather than as objective certainties (p. 253). Hence, evidence is not seen as reflecting reality, but rather as influencing our own evaluation of reality, consistent with constructivist assertions that only belief, and not objective knowledge, is possible. In light of this, Furner (2004) proposes a less positivist definition of evidence as that which serves as (or that which provides) grounds for a person's belief in the truth of a target proposition or conclusion. We might wish to say, for instance, that a proposition p is evidence for q if it is grounds (i.e., reason, cause, warrant) for believing q (p. 255).

This is of paramount relevance to this study, because we are not aiming to evaluate the evidence or its correspondence to reality, but rather to describe how that evidence is evaluated to support beliefs.

Importantly, this characterizes evidence not in the binary terms of proof or disproof, but rather as a matter of degree (Furner, 2004; MacNeil & Mak, 2007). In other words, the degree of belief is a measure of how strong the evidence is, or how much it is determined to support the proposition. As Fallis (2004) puts it, if the evidence of accuracy is better than the evidence of inaccuracy, the claim is likely to be accurate. The level of confidence in this assessment would be determined by how much more evidence is found for accuracy than for inaccuracy. It is in this context that we are said to consider the strength or “weight” of evidence. The criteria by which the weight of evidence is measured include its degree of remove from the proposition, its directness or indirectness, its degree of consensus or contradiction, and its logical consistency.

The strongest evidence for any proposition is firsthand evidence, such as actually observing the event or proposition itself.³ Direct observation is often impossible, however, for any number of reasons. We rarely if ever see facts; we usually only see evidence (MacNeil, 2000). This is particularly true in the case of predictive evidence and evidence of causality. A person forming a belief about vaccine safety, for example, cannot observe the effect of vaccination or non-vaccination in the future, nor can he or she observe a vaccination initiating some process in the body that results in autism. He or she can only directly observe the vaccination and the symptoms. Most evidence, therefore, exists at some level of remove from the event or proposition that it purports to prove. This is similar to the distinction in the law between direct evidence and circumstantial evidence, where direct evidence of an event is provided through the testimony of a firsthand witness, whereas circumstantial evidence requires

³ Although, of course, as any magician knows, even direct observation is imperfect.

an inference based on other evidence (Furner, 2004). This suggests two categories of secondhand or indirect evidence, that based on reason (Furner; MacNeil, 2001) and that based on testimony (Fallis, 2006, 2008).

Indeed, most of the evidence that anyone evaluates about anything is actually secondhand evidence received through the testimony of others (Fallis, 2006, 2008) including through reading, anecdotes, or the media. This necessitates a second layer of evidence evaluation, for now to form a belief one must evaluate both the proposition itself and the source of information about it (Fallis, 2006, 2008; Van House, 2004). As we shall discuss later, there are numerous criteria by which people evaluate sources.

The one most relevant to considerations of the weight of evidence is the idea of consensus. While we may have reason to doubt the reliability of any particular source, the accumulation of numerous sources that are in agreement tends to improve the probability that we believe a proposition. Indeed, accumulation and frequency of evidence affect the weight of direct evidence as well, for the more evidence we observe for a particular proposition, the more inclined we are to believe it. This depends on the premise that factors which might compromise the credibility of any particular piece of evidence, such as bias or error, become less and less likely with each additional piece of supporting evidence. While this is a helpful technique, it is imperfect, since it is nonetheless possible for consensus to be incorrect due to embeddedness within institutions and social circles that support particular points of view (Zucker, 1977; Granovetter, 1985). For example, one cannot judge the evidence for climate change or the theory of evolution based upon the number of people who reject them. Indeed, from a positivist/objectivist perspective, the number of people who believe in a proposition is not necessarily a measure of any objective reality.

A better measure, according to some paradigms, is the second category of indirect evidence, that based on reason. Our inferences about the relationship between two facts, such as that one fact is evidence for the other, are based on logical principles that we believe connect the two facts (MacNeil, 2000). These can include generalizations, hypotheses, induction and deduction (Furner, 2004). In essence, A is only good evidence of B if the relationship between A and B is logical. An example of this is the correlation-causation fallacy, where the observation of two sequential events may appear to be evidence that one event caused the other. This is a commonly cited reason for doubts about vaccine safety, where parents observe the appearance of symptoms shortly after their child received a vaccination and thus conclude the vaccination caused the symptoms. From a rationalist perspective, even these direct observations by parents are poor evidence of causation, because the conclusion does not necessarily follow from the premises. Indeed, according to the principle of evidence by induction, if the connection between the evidence and the proposition is logically fallacious, then the evidence is weak (Furner). Thus the very strongest evidence is evidence that contradicts the proposition, for while no number of swans can definitively prove the proposition that all swans are white, a single black swan can refute the proposition (Popper, 1959.) Rationalists contend that logically sound conclusions are objective evidence, because they follow from natural laws of the world that do not arise from interpretation. However, as we shall discuss later, rational processes are complicated by emotion and bias (Haidt, 2001; Kuklinski et al., 2000; Slovic et al., 2004) and may seem more objective than they really are (Mooney, 2011).

In summary, we can define evidence as that which is assessed in forming a belief. By Gilbert's (1991) definition of belief, this would mean that which is assessed in forming a positive mental representation of information. In the classic epistemological definition of knowledge,

“justified true belief” (Fallis, 2006; Furner, 2010), evidence would be that which is used to justify a belief as true. Supporting evidence strengthens belief that the proposition is true, and contradictory evidence weakens that belief. The strongest evidence comes from one’s own firsthand observations, but most evidence comes from secondary sources either through the testimony of others or through logical inference. When speaking of the kinds of things that evidence is evidence *of*, we are usually referring either to historical evidence that suggests events have taken place in the past, or predictive evidence that suggests the likelihood of events occurring in the future based on the historical observation of causal relationships.

Evidence Evaluation

With this epistemological and ontological background, we can begin to explore theories of how misinformation is believed. As previously noted, the assessment that underlies belief has elements of rational analysis and elements of intuition, some conscious and some subconscious, some psychological, some social and some cultural. The circumstances of evaluation and the experiences of the evaluator both influence what evidence is considered and how it is assessed.

Case’s (2007) broad survey of information seeking research suggests several aspects of information seeking behavior that may lead to misinformation. The first relates to Zipf’s law of least effort, which describes a seeker’s “tendency to rely on easily available sources” and “the first satisfactory solution to a problem” (Case, p. 8). This suggests that misinformation may result from less than thorough investigation of an issue. In this regard, Case outlines how different motivations and pressures can result in differing degrees of thoroughness. One common tactic is the idea of *satisficing* where, in the face of information overload, a seeker tailors and filters information as a strategy for time management and volume control (see also Bawden & Robinson, 2009). A frequent means of doing so is through *selective exposure*

whereby searchers tend to seek information that is “congruent with their prior knowledge, beliefs and attitudes” (Case, p. 336). Because of the present study’s interest in belief, it is interesting to consider that this, as Case describes, is a means by which belief can constrain information seeking behavior, including the motivation to seek at all. If a seeker will cease seeking once he or she feels that an information need is met, it may be that he or she is more likely to direct the search toward simple, comfortable information rather than complex, challenging information that might prolong the search, as indeed other research suggests (Hart et al., 2009; Lewandowsky et al., 2012; Metzger et al., 2010; Nyhan, 2010). The result of these strategies, however, can be a failure to be as complete and accurate as possible.

The preference for familiar information apparently extends to information sources as well, as Case’s (2007) survey suggests that people tend to favor their own experiences or their personal contacts over other sources, including doctors. Importantly, in several of the studies that Case cites, the Internet seems to rival interpersonal relationships as the most important information sources. Indeed, the Internet itself is also seen as “a source of interpersonal communication and emotional support” (Case, p. 298). This is notable in light of arguments that the Internet exacerbates misinformation. White (2014) found that pre-existing beliefs influence search behavior and that search engine ranking can influence beliefs. Other researchers have found similar results with regard to searches about vaccine safety in particular (Betsch, 2011; Downs, de Bruin & Fischhoff, 2008; Ruiz & Bell, 2014). Several studies have also found that vaccine criticism is more prevalent and prominent on the Internet than in the medical consensus (Betsch, 2011; Betsch, Renkewitz, Betsch & Ulshofer, 2010; Betsch et al., 2012; Davies, Chapman & Leask, 2002; Kata, 2012).

The concept of satisficing in the face of the Internet's enormous quantity of information is at the center of many theories of Internet misinformation. Metzger et al. (2010), for example, compare mass media and new media environments in terms of abundance and scarcity. They see mass media, with fewer information producers, as an environment of information scarcity that provides more content gatekeeping and requires (and enables) less verification on the part of the consumer. The Internet, by contrast, is an environment of information abundance where verification is both easier and more necessary. The strategies for evaluating such enormous quantities of information, however, may have serious consequences for information quality.

Swinnen et al.'s (2005) examination of media organizations predicts a "rationally ignorant consumer," meaning that constraints of budget and time make it "rational for consumers to be imperfectly informed" (p. 178). They identify three reasons for this. First, if the cost of new information is higher than its benefit, then "consumers will prefer to inform themselves only up to a point where further acquisition of information will be too costly" (p. 178-179). Second, if "opportunity costs" are too high, a consumer will prefer to be imperfectly informed. For example, most consumers simply do not have the time, skills or resources to verify every bit of information they encounter. Third, if information diverges from a consumer's ideology, the benefit of consuming it must be greater than the threat of the divergence, a concept that recurs throughout similar literature, as we shall see. Overall, in economic terms, if information is not to a consumer's taste, he or she will not bother with it unless he or she anticipates some benefit from it.

Metzger et al. (2010) found that Internet users adopted certain cognitive shortcuts in their evaluation of credibility. In particular, the researchers distinguished five different heuristics that subjects employed in order to make their credibility judgments when lacking the time or

motivation for deeper analysis. The first, the *reputation heuristic*, was employed because evaluators preferred well-known sources and information to lesser known ones. The similar *endorsement heuristic* found evaluators trusting information because others trusted it. This idea of consensus was also key in the *consistency heuristic* by which evaluators in the study attributed credibility when they perceived agreement among several sources. The subjects of the study also used heuristics to identify sources that were *not* credible, such as the *persuasive intent heuristic* by which evaluators doubted the credibility of a website if they perceived that it was trying to market to them or otherwise persuade them of something. A fifth heuristic, the *expectancy violation heuristic*, found evaluators distrusting sources that did not meet their expectations. This heuristic was invoked in many different ways, including when the website sought more information than the user deemed necessary, or when the site redirected to another site. In line with the recurring findings of other studies, one violation of expectation that the subjects perceived was a violation of their existing personal beliefs. In other words, if the site did not agree with what they already believed, users tended to doubt its credibility. Some even stopped searching after finding confirmation, and actively avoided contrary information. Metzger et al. are quick to point out that such shortcuts may or may not have a negative impact on the quality of information evaluation, since on the one hand the use of heuristics may be biased or cause mistakes, while on the other hand it makes the processing more efficient and is often equally effective.

The ease with which the Internet enables such behavior is a chief reason why the consumer is so important to considerations of misinformation on the Internet. As Floridi (1996) predicted, the Internet allows a consumer to personalize information quite easily to his or her own tastes, and thus to his or her own biases. A consumer, under the impression that the

Internet makes him or her better informed, is increasingly likely to be subject to his or her own idiosyncrasies. This *information tailoring*, as Floridi calls it, could result in *self-disinformation*, a process by which information consumers misinform themselves.

The means by which this might occur, as Hitlin (2003) and Sunstein (2007) worry, is that once there are too many Internet users, they fragment into interest groups that limit their information consumption and revert to the influence of what amounts to small information monopolies. As one strategy for managing information overload, information consumers utilize filtering and personalization tools to favor one kind of information over another. This often means excluding information they have not sought out, including information that might expand or challenge their beliefs. Indeed, Metzger et al. (2010) observed exactly this behavior among the subjects of their study, who explicitly favored websites with views similar to their own (see also Hart et al., 2009). In this personalized Internet environment, Sunstein (2007) argues, the loss of the “general-interest intermediaries” like mass media and newspapers means the loss of unexpected encounters with new and diverse ideas and shared experiences. For Sunstein the “fragmentation and extremism” that could result might have enormous consequences for democracy because of its potential to isolate people from each other ideologically (p. 5-6). At the same time, attempts to empirically measure such effects have found the concerns to be exaggerated (Garrett, 2009; Jang 2014).

Eli Pariser (2011) worries that the exclusions of filtering and personalization are not only created by the user, but are also increasingly automated in the algorithms of sites like Facebook and Google. Because each of these sites monitors and analyzes user behavior, they automatically provide the information consumer with information tailored to his or her previous behavior. Hence, for example, Google might record a person’s preference for sites of a particular political

point-of-view, then favor results from those sites in subsequent search results. Likewise, as Pariser observed in his own experience, Facebook might exclude new, diverse or challenging ideas because its automatic system favors content posted by friends with whom the user interacts most. Of particular importance to Pariser is the fact that such filtering strategies are invisible to the user of the sites. Hence, an information consumer may be burrowed into an ideological echo chamber unknowingly or even unwillingly.

Interestingly, however, other researchers have suggested that Pariser may be exaggerating the problem, as they have had difficulty reproducing Pariser's results (Weisberg, 2011). Likewise, Weinberger (2011) notes that filters do not actually remove any information; they merely increase the effort needed to locate it. Even Sunstein (2007) acknowledges that the Internet also provides immense opportunity to find new things that were once much more difficult to find, as Floridi (1996) had previously predicted. The difficulty, however, is that this potential of the Internet requires that users actually seek out a diversity of information which, as we shall see, they may not do.

Indeed, even consumers that are exposed to diverse information may be inclined to reject it. Attempts to correct misinformation often fail to change beliefs (Lewandowsky et al., 2012) as Nyhan et al. (2014) found was specifically the case with attempts to correct attitudes toward vaccination. This is because people—all people, not necessarily misinformed ones—tend to get entrenched and protect their existing beliefs. Hart et al. (2009) conducted a meta-analysis of studies regarding bias toward congenial or uncongenial information and confirmed that people often have a preference for information that confirms their pre-existing beliefs. Information evaluation is guided either by the *defense motivation* to defend existing beliefs or the *accuracy motivation* to make accurate evaluations. One may prefer congenial information when faced

with threat or discomfort, including “from a self-threat, such as the perception that one is poorly informed” (p. 557). In addition, an expectation of high quality information may enhance the defense motivation bias toward confirmatory information, as may a high level of commitment to one’s opinions.

Much psychology research attributes these cognitive biases to the integral relationship between reason and emotion. Slovic et al. (2004) emphasize the influence upon reason of affect, the fast, automatic intuition that something is either good or bad. “People,” Slovic et al. write, “base their judgments of an activity or a technology not only on what they *think* about it but also on how they *feel* about it” (p. 315, emphasis in original). Haidt (2001) describes how, contrary to glorification of humans as reasoning through clues toward a correct conclusion, we most often make quick, intuitive judgments that we retrospectively justify through reason. “The emerging view in social cognition,” Haidt writes, “is that most of our behaviors and judgments are in fact made automatically” (p. 819) rather than through reasoned steps of deliberation. Gilbert (1991) finds that disbelief is more cognitively difficult than belief, because the brain must accept a proposition before it can doubt it. Belief, in other words, is automatic, but disbelief requires “deliberate revision” (Gilbert, p. 108). This causes us to bias our information searches towards supportive information, and apply more scrutiny to opposing evidence (Haidt). As Mooney (2011) notes, this is particularly easy to do with scientific evidence, which is complex and prone to misunderstanding (see also Munro, 2010). In addition, as Carl Sagan (1996) noted, certain kinds of unsubstantiated beliefs provide a sense of order or control, and therefore have strong emotional motivations. Knowingly or unknowingly, many consumers would rather be comfortable than fully informed.

One famous theory that may be applicable is Sherif's social judgment theory (Sherif & Hovland, 1961) which models human judgment as based upon an "anchor" of previous experience. Each person judges how far a new idea deviates from that anchor. The degree of that deviation either falls within the latitude of acceptance, which means an evaluator will agree with the idea, the latitude of rejection, which means an evaluator will not agree, or the latitude of noncommitment. This judgment is influenced by the involvement of the ego, such that great ego involvement means a larger latitude of rejection, a smaller degree of noncommitment, and a lower expected change in belief.

Kahneman (2011) has famously divided cognitive processing into two systems. "System 1" is the more automatic system, and "system 2" the more deliberative and effortful. These two systems are not independent, but influence each other in ways that affect how we evaluate information:

System 2 is more of an apologist for the emotions of System 1 than a critic of those emotions— an endorser rather than an enforcer. Its search for information and arguments is mostly constrained to information that is consistent with existing beliefs, not with an intention to examine them." (pp. 103-104).

One of the consequences of this interplay of cognitive systems is a bias in our perception of risk. As Kahneman puts it, "Our expectations about the frequency of events are distorted by the prevalence and emotional intensity of the messages to which we are exposed" (p. 138).

Kahneman's two systems are similar to the elaboration likelihood model of Petty and Cacioppo (1986) which distinguishes between central and peripheral processing. Central processing involves much more critical thinking than peripheral processing, including a greater diversity of sources. Which of the two processing strategies a particular believer adopts depends

upon motivation and ability. The more relevant a topic is, the more likely the evaluator is to think critically about it, and the less relevant, the more likely the evaluator is to accept the new idea based upon other criteria, such as the credibility of a source.

In a complementary model, DiMaggio (1997) distinguishes deliberative cognition, the kind of critical thinking that would tend to discourage misinformation, from automatic cognition, the uncritical acceptance of ideas. DiMaggio, a sociologist, notes that automatic cognition derives from social structures that “provide default assumptions” about ideas (p. 269). In other words, information consumers derive many of their own beliefs from the existing belief structures in their society. DiMaggio further notes that this is consistent with Merton’s theory of pluralistic ignorance in which “people act with reference to shared representations of collective opinion that are empirically inaccurate” (p. 272). This idea of “cultural cognition,” as Kahan (2010) puts it, “causes people to interpret new evidence in a biased way that reinforces their predispositions. As a result, groups with opposing values often become more polarized, not less, when exposed to scientifically sound information” (p. 296).

This influence of social factors on psychological states is at least partially explained by Granovetter’s (1985) idea that most behavior cannot be separated from the interpersonal relationships in which it is embedded, while at the same time actors behave neither outside society nor entirely at the mercy of it. One effect of this embeddedness is to emphasize commitment and thereby discourage change by keeping behavior obedient to existing norms and values. Staw (1981) identifies four social reasons why we tend to commit more strongly to beliefs when they are challenged: the need to justify previous actions, the influence of norms for consistency, and a consideration of both the probability and value of future results. All of these

factors are motivated both by an internal need to feel competent and an external need to demonstrate competence to others.

A related insight from the Rogers model of diffusion (Hall, 2004; Rogers, 2002) is the influence of charismatic opinion leaders or change agents who, predictably, make adoption more likely. This would seem to be consistent with the findings of Vornik, Sharman and Garry (2003) that power and social attractiveness were particularly persuasive with misinformation. Importantly, however, this is not the same as saying that celebrities influence our beliefs, as many people are inclined to believe, since Rogers also notes that while mass media sources are effective at creating knowledge about a new innovation, they do not encourage adoption of that innovation as effectively as interpersonal channels of communication do. This applies not only to celebrities, but to mass media dissemination of science, for “most individuals evaluate an innovation, not on the basis of scientific research by experts, but through the subjective evaluations of near-peers who have already adopted the innovation” (Rogers, p. 990). Granovetter (1973) similarly suggests that weak social ties are effective at spreading information, but may be less effective than strong social ties at reinforcing belief. On one hand, this means that the information that is most accessible through weak ties is the information that might challenge the insular values that strong ties reinforce. This comports with Floridi’s (1996) and Fallis’s (2008) assertion that access to a diversity of information might be the best counter to misinformation. However, access to information does not always amount to belief in it, and given Rogers’s and Granovetter’s emphasis on the influence of strong interpersonal relationships, strong ties may be better than weak ties at converting misinformation into belief.

Strong, misinformed belief is often studied in the context of conspiracy theories. Skepticism about vaccine safety has some similarities to conspiracy theories, in particular the

assertion that pharmaceutical companies are conspiring to hide evidence that vaccines are dangerous (Kennedy, 2005). Several studies have found that conspiratorial thinkers are commonly alienated by a lack of education, lower socioeconomic status, and a lack of political power (Goertzel, 1994; Stempel, Hargrove & Stempel, 2007). Such findings may not apply to controversies about vaccine safety, however, since anti-vaccination beliefs are more prominent among the affluent and well-educated. At the same time, conspiratorial thinking is also most common among members of marginalized groups with “us versus them” worldviews, and as a “populist protest against powerful elites” (Stempel et al., p. 356). Notably, anti-vaccination beliefs are sometimes rooted in anti-corporate sentiments, anti-government sentiments, and feelings that personal liberty is infringed by vaccination schedules. This is further elaborated by Swami, Chamorro-Premuzic and Furnham (2010) who have found that rejections of mainstream views are often motivated by a distrust of the institutions from which those views originate. Such skepticism is at the heart of the frequently articulated motivation for doubts about vaccine safety that pharmaceutical companies spend money to influence both research findings and the recommendations of medical organizations.

Kuklinski et al. (2000) articulate an additional aspect of political belief that may be applicable to vaccine safety beliefs, which is the distinction between being uninformed and being misinformed. Many people are not uninformed, but rather believe incorrect information which they then use to form preferences. With many conspiracy theories, believers have meticulously researched the smallest details of the issue, and hence certainly do not believe out of ignorance. Yet Kuklinski et al. also found that it is those who are misinformed, rather than those who are uninformed, that are most likely to resist facts that contradict their beliefs. Lewandowsky et al., (2012) agree:

Ignorance rarely leads to strong support for a cause, in contrast to false beliefs based on misinformation, which are often held strongly and with (perhaps infectious) conviction.

For example, those who most vigorously reject the scientific evidence for climate change are also those who believe they are best informed about the subject (p. 10).

One possible explanation for conspiracy theories, therefore, may be that believers are thoroughly informed, but by biased, unreliable, or otherwise insufficient sources. Stempel et al. (2007) found a strong suggestion that “less legitimate and less regulated media sources, such as tabloids, Internet blogs, and radio talk shows, play a prominent role in creating conspiracy beliefs” (p. 355). They also found “robust positive associations between belief in conspiracy theories and higher consumption of non-mainstream media (blogs and tabloids)” (p. 366). Jenkins and Thorburn (2003) similarly suggest that many alienated (political) groups use alternative media because the mainstream media will not take them seriously.

A final useful framework for understanding vaccine safety beliefs comes from Rogers (2002), who has applied his famous theory of the diffusion of innovation to identify five factors influencing the adoption of preventive innovations in particular. The first of Rogers’s categories is the *relative advantage* of the innovation, or how much better the innovation seems than the prior technology. Obviously, people will adopt vaccines if they perceive them to be advantageous. Rogers’s second category, *compatibility*, refers to how consistent the innovation is with existing values, needs, and past experiences. This is consistent with the psychological research we have already discussed. The third factor affecting diffusion is *complexity*, or how difficult the innovation is to use. With regard to vaccines, it certainly seems plausible that the complexity of the technology, the human immune system, and disease contagion may make vaccine safety more difficult to believe. Rogers’s last two categories, *trialability* (ease of

testing) and *observability* (visibility to others) are probably crucial to vaccine adoption, since the average consumer can neither test vaccine safety themselves nor directly observe conferred immunity, both of which would provide obstacles to vaccine adoption.

In summary, there are several qualities of human behavior, sociality and cognition that may encourage misinformation, particularly in the face of the immense size of the Internet. Strategies for managing information overload, such as heuristics, filtering and personalization, may exclude contradictory information that could dilute misinformation. At the same time, the avoidance or discounting of contradiction is a basic human instinct, given our unconscious biases and the influence of emotion on cognition. In addition, we are more likely to embrace the values of those cultures in which we are embedded and more likely to reject the values of the cultures from which we feel alienated. Particularly notable across the breadth of scholarship are the recurring references to the influence of personal experience and the assessment of the experiences of others. Evidence evaluation does not take place in a vacuum of pure reason. All of these factors—internal and external, past and present—may have an influence not only on how we evaluate evidence, but even what evidence we choose.

Criteria for Evaluation

A large body of scholarship has attempted to identify the specific criteria that people employ when evaluating information. Though some of this work is specific to the Internet, it is rooted in basic considerations of information literacy and the concerns of information professionals with providing quality materials and thorough education in the use of them. Importantly, many studies of users as they evaluate information indicate that they apply different criteria in different situations (Metzger, 2007; Metzger et al., 2003; Rieh & Belkin, 1998) depending on the importance of the information (Rieh & Danielson, 2007), the context (Metzger;

Rieh & Hilligloss, 2008) and the level of skill (Ahmad, Komlodi, Wang & Hercegfi, 2010). Hence the evaluation of evidence is both subjective and contextual.

Much of the literature about evaluating information refers to the broader concept of information quality. Many of the criteria for information quality are applicable to evaluating misinformation, and many are not. For example, criteria for quality that are common across multiple sources (Ambre, Guard, Perveiler, Renner & Rippen, 1997; Grassian, 1995; Price & Hersh, 1999; Rieh & Belkin, 1998; Rieh & Danielson, 2007) include accuracy, comprehensiveness, currency, reliability and validity, while less common criteria include authority, credibility, verifiability, bias, and the hierarchy of evidence. All of these criteria may help in identifying misinformation. On the other hand, other common measures of information quality, such as relevance, usability, design, popularity, grammar, spelling and composition, seem unlikely to correlate with misinformation. Among the terms applicable to misinformation, accuracy seems the most relevant, since the common, positivist definition of misinformation is essentially information that is not accurate. Accuracy is usually defined as being free from error (Fallis, 2004, 2006, 2008; Kelton, Fleischmann & Wallace, 2008; Metzger et al., 2003). The question then becomes how information consumers might evaluate accuracy.

Accuracy.

As previously discussed, there are two ways to evaluate and verify a proposition: either through direct experience or through the testimony of others (Fallis, 2004; see also Rieh, 2002). While direct observation may seem the most likely to be accurate, since it would seem to be unfiltered, as we have seen it is in fact filtered through the perceiver's own biases, particularly toward preexisting beliefs. Furthermore, we acquire most of our knowledge from secondary sources (Fallis, 2006, 2008). Each of these sources may have biases of its own, and it is very

difficult to detect those biases when evaluating the source. On the Internet, however, everything is essentially a secondary source. Verification of accuracy on the Internet, therefore, is essentially the verification of (recorded) testimony – of determining upon which testimony it is best to rely.

Taraborelli (2008) notes that we adopt “epistemic deference” toward external sources of information in order to extend our beliefs beyond the limits of our own ability to evaluate. In other words, we defer evaluations to others when it is too difficult to do the evaluation ourselves, because we lack the time, skills, or access to the evidence. This means we must defer *evaluative judgments* or “extensive inspection of the content and credentials” in favor of *predictive judgments* which determine the “expected reliability of a source prior to its actual inspection” (Taraborelli, p. 196; see also Rieh, 2002). In essence, predictive judgments are educated guesses about how richer evaluative judgments might go. With regard to the accuracy of information, this might equate to using predictive judgments to evaluate information based on its source when it is too difficult to perform evaluative judgments based on its content.

Thus, an information consumer might evaluate accuracy by seeking independent corroboration of a proposition (an aspect of many of the heuristics discussed in Metzger et al., 2010). As Fallis (2004) notes, the number of believers of any factual claim is likely to be lower for misinformation than for accurate information. This is not always the case, however, as consensus can build around incorrect information (del Giudice, 2010). For example, it is quite easy—particularly on the Internet—to find numerous sources supporting a conspiracy theory, questioning climate change, or challenging the theory of evolution. The number of believers alone, therefore, is likely a better measure of the prevalence of an idea than of its validity. In addition, “Repetition effects may create a perceived social consensus even when no consensus

exists” (Lewandowsky et al., 2012, p. 113). In this regard, Fallis emphasizes that “agreement between sources should not increase our degree of confidence in the accuracy of a piece of information unless those sources are independent” (p. 471). Without this limitation, an evaluator could be fooled by false consensus. In the end, the reliability of an evaluation based on consensus would depend on whose consensus was noted. Information supported by the best sources would be considered the most likely to be accurate. The process of determining which are the best sources, of course, is an equally complicated task.

Verification through corroboration is also complicated by the black swan problem, which suggests that corroboration can never prove an assertion correct, but falsification can prove it incorrect (Popper, 1959). For example, Price and Hersh (1999) found it much easier to identify indicators of a lack of quality than of high quality, suggesting that the best criteria for identifying misinformation might be those that correlate with inaccuracy rather than accuracy. This may amount to seeking contradiction rather than corroboration. At the same time, this approach has limitations, since determining that two sources disagree does not by itself help to determine which source is more likely to be correct. Therefore, a robust falsification approach might also incorporate both the size of the disagreement and the identification of certain warning signs. Scholars have identified many such warning signs, such as requests for money, irrelevant credentials, appeals to emotion, unsubstantiated claims, and opinion markers (Fitzgerald, 1997), testimonials, guarantees and claims of persecution (Morahan-Martin & Anderson, 2000), or claims of ‘amazing results,’ ‘earthshaking breakthroughs,’ or the ‘secret cure’ (Ambre et al., 1997). Sites that are widely contradicted by credible sources, and that display these or other warning signs, may have a higher probability of misinformation.

As many scholars note, the most important measure of an indicator of accuracy is that it actually correlates with accuracy (Fallis, 2004; Taraborelli, 2008). Many of the studies on the subject are about what individual people use as indicators. That is not necessarily the same thing as what they *should* use, because what users expect to correlate with accuracy may or may not actually correlate (Fallis, 2004).

In several studies, Fallis and Fricke have attempted to empirically evaluate the correspondence between accuracy and any particular indicators of it. In one study, they took several indicators from published guidelines and compared them to various websites about treating fever in children (Fallis & Fricke, 2002). They found three indicators correlated with accuracy: a HONCode logo (the seal of the Health on the Net Foundation indicating that certain standards have been met), a dot-org domain name, and the display of copyright information. Some expected indicators did not correlate well with accuracy, including the identification of an author or the author's having medical credentials, and some did not correlate with inaccuracy, such as a lack of currency or the presence of advertising. In a subsequent study involving websites about Ewing's Sarcoma (Fricke & Fallis, 2002) they found only one indicator—a dot-com domain—correlated with accuracy. Likewise, they found a lack of correlation with expected measures, including the medical credentials of the author.

A few years later, Fricke and Fallis (2004) applied similar methodology to ready reference websites, testing similar but slightly different criteria for correlation with accuracy or inaccuracy. Again they found that the presence of advertising did not correlate with inaccuracy. They also found that currency and the presence of copyright information did correlate with accuracy, as did three link analysis metrics: placement in search results, Google toolbar score, and the number of in-links. In a study the following year (Fricke, Fallis, Jones & Luszko, 2005)

about carpal tunnel syndrome, they again found that the link analysis metrics correlated well with accuracy, and medical credentials did not correlate. In this study, they explicitly tested for biased content and found that unbiased discussion correlated with accuracy and biased discussion with inaccuracy.

Of course, the inconsistency of the results of these studies is problematic. For example, one study finds that accuracy correlates with a dot-com address and another with a dot-org address. Similarly, certain correlations, such as that between accuracy and the display of copyright information, seem coincidental and, once identified, would be quite easy to fake. Likewise, correlations found in one study, such as a HONCode logo, are not replicated in other studies. Even Fallis's most consistent result, a correlation between accuracy and a high number of in-links from other websites, is a correlation that is likely to represent popularity and notability rather than accuracy.

Overall then, while many existing techniques can begin to address the problem, the evaluation of accuracy is a difficult and imperfect task. In principle, accuracy is an objective characteristic of information. As we have seen, however, that formulation is complicated by the knowability of truth and the reliance on secondary sources. One must always decide whose representations to privilege. This is a noteworthy conundrum that amounts, in some sense, to not evaluating accuracy at all, but rather some subjective proxy for accuracy. Existing scholarship has grouped around four possible such proxies: authority, credibility, trust and authenticity.

Authority.

The determination of whose agreement or disagreement is most useful amounts to determining the authority of a particular source. The most widely cited concept of authority is that of *cognitive authority*, which Patrick Wilson described as influence on thoughts by a

knowledgeable source that is worthy of belief (Fritch & Cromwell, 2001; Rieh, 2002; Rieh & Belkin, 1998; Savolainen, 2007). Websites with high authority may be more likely to be accurate, and those with low authority may help identify misinformation (Fritch & Cromwell). For example, a claim is more likely to be accurate if it appears in a respected newspaper or on the website of a respected medical organization, while it is more likely to be misinformation if it appears on conspiracy websites or websites with a political bias, but does not appear elsewhere.

Authority by itself has notable limitations as a predictor of misinformation. For example, sources could be given false authority, and authoritative sources can be wrong. Likewise, the authority of a source is a macro level analysis that might be a poor criterion for any particular piece of information. For example, the authority granted *The New York Times* might differ from the authority granted any particular article, let alone any comment in response to an article. Furthermore, totalitarian regimes would seem to have authority, but can also be sources of disinformation. Yet without the concept, no evaluation of misinformation could be complete.

For traditional, paper publishing, there are established criteria for determining the authority of a source, including information about its author and publisher, but these criteria are not as applicable to the Internet, primarily because they are not as easy to determine (del Giudice, 2010; Fritch & Cromwell, 2001; Rieh & Belkin, 1998). As criteria for determining the authority of online sources specifically, Fritch and Cromwell suggest author competence and trustworthiness, document validity and author affiliation, the detection of all of which is not always easy on the Internet. For Rieh (Rieh, 2002; Rieh & Belkin), the concept of authority is close to credibility, for the cognitive authorities we recognize are those we find credible. Indeed, Savolainen (2007) observes that cognitive authority is the concept favored by information scientists to describe what communications scholars call credibility. It is, in fact, in the literature

explicitly exploring credibility that the criteria for evaluating cognitive authority are best articulated.

Credibility.

As a proxy for accuracy, credibility is imperfect. Fogg and Tseng (1999) equate credibility with believability. This definition is problematic for understanding misinformation, however, in that presumably misinformation is believable to those who believe it. Similarly, credibility is of course not the same as accuracy, and refers only to perception and not any kind of objective correspondence to the truth. As Rieh and Danielson (2007) note, “credibility assessment is inherently a matter of human judgments and document attributes provide only the cues for such judgments” (p. 343). In addition, a credible source can still make mistakes or even deceive. Credibility describes an information source that usually contains true information, but it does not mean any particular thing is true. On the other hand, credibility is important to accuracy in that if a source is not perceived as credible (predictive judgment, Taraborelli, 2008) it will not be consulted (evaluative judgment) regardless of whether or not its information is accurate.

A large body of scholarly studies examines the criteria that users adopt when evaluating the credibility of information (Ambre et al., 1997; del Giudice, 2010; Fogg et al., 2003; Kubiszewski, Noordewier & Costanza, 2011; Metzger, 2007; Metzger et al., 2003; Price & Hersh, 1999; Rieh & Danielson, 2007; Wathen & Burkell, 2002). While there is much overlap between the criteria used by different studies, there is also much variation, and a list of who adopts which criteria would be both voluminous and incomplete. For example, Del Giudice’s (2010) most cited criterion (credentials) was employed by only 72% of her subjects. It appears that none of these criteria was used by even close to 100% of users. Furthermore, it is difficult to

determine whether terms used in different studies—such as bias, fairness and objectivity—are synonymous or distinct from one study to the next. Certain interesting trends emerge, however, as to which criteria are frequently used and which rarely.

Among the most commonly cited criteria are accuracy and bias. Thus, there is circularity inherent in using credibility as a proxy to evaluate accuracy, since accuracy is one criterion for credibility. Furthermore, most of the studies offer no insight into how subjects determined the accuracy of the information, even when they identified it as a criterion. Bias, however, is likely to be a major cause of misinformation, and a major factor in how information consumers evaluate misinformation. How these consumers gauge the bias of others, especially in light of their own biases, is a crucial element of this investigation.

Not surprisingly, the subjects of many user studies reported using the author's identity, his or her credentials or expertise, and any perceived goals or objectives as criteria for evaluating credibility. The currency of information is also frequently cited, presumably on the assumption that information that has not been recently updated is unlikely to be correct. Likewise, information that is perceived to be complete and/or comprehensive was also perceived to be credible, presumably because omissions can be misleading and suggest insufficient understanding of the topic.

Many of the studies had more unexpected or confusing results. Some criteria that would seem to correlate strongly with accuracy, such as editorial review (Ambre et al., 1997) and validation by other sources (Metzger, 2007; Metzger et al., 2003), were almost never identified as criteria that real information seekers actually use. In addition, many of the criteria seem dangerously tautological, such as the use of reliability, believability and trustworthiness as criteria for credibility. Relevance and utility were often noted, but it is difficult to see how they

affect credibility per se, since a website giving health advice could be entirely irrelevant to a search for political news, but nonetheless be perfectly credible. Perhaps most surprisingly, aesthetic design features of websites were among the criteria most commonly used by information seekers in these studies. Intuitively, it seems quite unlikely that such factors would correlate with accuracy, or even with credibility. Yet use of these criteria for evaluation is quite common, including in the Fogg et al. (2003) study, where design look was the most frequently mentioned criterion. Interestingly, Kubiszewski et al. (2011), who divided the various criteria into a “credibility factor” consisting of criteria relating to authorship and content, and a “presentation factor,” consisting of design features, applied a statistical analysis which found that the credibility factor was significant, but not the presentation factor. In addition, Ahmad et al. (2010) found that aesthetics mattered more to inexperienced computer users. It is interesting to consider how often aesthetic criteria were employed, given that such criteria are unlikely to correlate with accuracy.

In addition to criteria, Wathen and Burkell (2002) were able to rank the perceived credibility of various sources of medical information. Doctors were trusted most, followed by mass media, other health professionals and health publications. However, doctors may not rank as highly among those doubting the safety of vaccines. In a related finding, Casiday, Cresswell, Wilson & Panter-Brick (2006) observed that “parents made a distinction between ‘doctors’ and ‘my doctor,’ trusting their own doctors far more than the medical establishment” (p. 181). Among institutions in the Wathen and Burkell study, consumer advocacy groups were perceived as the most credible, as were famous organizations such as the Mayo Clinic. The study also found some distrust of government sources, and a general distrust of corporations, especially pharmaceutical companies. Findings such as these suggest that vaccine safety beliefs might

derive from a preference for information from one source, such as an advocacy group, over another, such as the government.

Notably, many of these credibility evaluations are not information-level evaluations. Rather, they are evaluations of the source of information. Indeed, credibility judgments are often based upon trust, a key element of which is that trust in information is based on an assessment of trust in the source of the information (Lucassen & Schraagen, 2011).

Trust.

As with direct and indirect evidence, the best way to form trust is to have personal experience with the person trusted. In this way, a trustor may evaluate trust by inferring the underlying motives of the trustee, by identifying common goals and values, or by forming an emotional relationship (Engdahl & Lidskog, 2014; Kelton et al., 2008). Of course, personal experience with the evaluator is not available in many situations, leaving most people to rely on the personal experiences of others (Taraborelli, 2008).

Gilson (2003) distinguishes between trust in known individuals and trust in strangers or social systems, which Kelton et al. (2008) call societal trust. This form of trust is an essential element of a functioning society, because without it we could not engage in transactions with strangers (Kelton et al.; Granovetter, 1985). It is often based on shared norms and values. As we have noted, interpersonal trust may have greater influence than societal trust and has more complex motivations (Granovetter, 1973; Hall, 2004; Rogers, 2002). As Gilson notes, interpersonal trust can be based on a calculation that the trusted person is acting in one's interests, or on a prediction that the trusted person will act consistently with his or her history of behavior. Perhaps more important for misinformation, however, is what Gilson calls affective or altruistic voluntary trust, which is instinctual trust based on emotional ties with the trusted person

(see also Engdahl & Lidskog, 2014). Such bonds are likely to be the most persuasive, but as Granovetter (1985) notes, they are also the most susceptible to abuse, and provide the basis for fraud and betrayal that would not be possible had no trust been established.

Quandt (2012) writes about the evolution of trust from interpersonal structures into network structures. In pre-modern societies, Quandt notes, information was most efficiently shared face-to-face, but as societies grew increasingly complex such efficiencies broke down and the need for information and knowledge intermediaries grew. This necessitated the rise of centralized information institutions (i.e. the media) and subsequently “an extension of the concept of ‘trust’ towards institutions” (p. 12). Ironically, as societies grew still more complex, they fragmented into subgroups, and those centralized media hierarchies had an increasingly difficult time meeting the information needs of the population’s diverse interests. As media became networked, Quandt argues, trust began to evolve:

In contrast to the generalized trust directed towards institutions... ‘network trust’ is based on an accumulated perception of ‘personalized,’ individual trust. Users of social media generally do not expect the participants of social media to have a hidden agenda or to be ‘puppets’ of a larger institutionalized entity in the background... The background of the participants in social media is not expected to be a uniform one – even though individuals might have certain interests and might be influenced by third parties, this is expected to be levelled out by the difference of voices in the ‘networked’ discussion... This widespread idealized notion of networked communication and network trust seems to miss some problems of social media and a ‘participatory’ network society – leading to a rather contradictory situation, where trust is given to mostly unknown, anonymous voices

on the web, whereas there is a lingering suspicion that institutionalized media are manipulative and not trustworthy (p. 14-15).

Notably, this network trust returns to the interpersonal trust of pre-modern societies, although it is now heavily mediated.

Metzger et al. (2010) found network trust manifested in “social information pooling,” which is commonly relied upon by Internet users evaluating credibility. New technologies for interpersonal connectivity and information aggregation create opportunities to supplement or replace single, hierarchical authorities with “multiple distributed authorities based on... networks of peers” (p. 415). In other words, traditional top-down evaluations based on authoritative experts are increasingly giving way to bottom-up evaluations based on collective opinion. The use of such technologies was common throughout the multiple focus groups in the Metzger et al. study. This was particularly true of testimonials from “real people,” such as product reviews, which some participants described as personalizing the evaluation. On the other hand, other subjects of the study felt that such testimonials deserved greater skepticism because of the difficulty of evaluating the identity, credentials and other important information about the source. For similar reasons, blogs, wikis, social networking sites and particularly Wikipedia were viewed with skepticism by Metzger et al.’s subjects.

Importantly, most systems discussed in the study, and most such systems in general, are employed to evaluate products and vendors, not the veracity of information. Nonetheless, the idea of collaborative evaluation is likely to be of some use to a study of vaccine safety beliefs, particularly on the Internet. To begin with, these kinds of systems are used online to evaluate potential sources of vaccine information such as pediatricians and books, and to determine the prominence of certain information in news feeds and search results.

While trust is also not the same as accuracy, and someone that we trust can mislead or even deceive us, there is an essential association between the two concepts in that we judge to be accurate that which we trust. Indeed, we use trust as a means of judging accuracy more than we use verification, largely because of constraints on time and effort. If we have come to trust our local newspaper, for example, we tend to believe what we read there is accurate, and rarely if ever verify it. On the other hand, as with credibility, trust is based on perception. Like credibility but unlike accuracy, trust is not an inherent or objective characteristic, but is instead an external evaluation. People evaluate trust not by evaluating content as much as by evaluating behavior and the judgments of others about that behavior.

Authenticity.

A final potential proxy for accuracy might be derived from archival theory, where the authenticity of a document is judged according to its provenance. Authenticity is not an explicit evaluation of content, however, but rather of whether a document is what it purports to be. Like the other proxies, these methods do not evaluate the accuracy of the information itself, but certain circumstances of creation might improve the probability that a document's contents are accurate. For example, the circumstances of the creation of an article in a peer-reviewed scientific journal, an article in a major newspaper, and an entry on an amateur writer's blog may all suggest different probabilities of the accuracy of their content. Indeed, authenticity is often a good means of determining cognitive authority, as among the considerations of an archival analysis are who authored a document, the purpose for which it was authored, and in what capacity the author served (Duranti, 1998). Yet authenticity is not limited to authorship alone, for as Fallis (2008) notes, "We typically trust a particular encyclopedia entry not because we trust its author but because we trust the process by which the entries in the encyclopedia are

produced” (p. 1667). It is exactly the process of production that is at the heart of most evaluations of provenance (Duranti).

In essence, as Duranti (1998) puts it, the authenticity of material “is determined by the juridical system in which it was created, by the person concurring in its formation and their competence, and by the actions, transactions, processes and procedures which generated it” (p. 183). The more an information consumer can determine about the circumstances that created information, therefore, the higher the probability that he or she can recognize misinformation when it occurs.

While these principles originate in the authentication of paper records, they have been applied to the authentication of electronic records as well. To begin with, archivists consider some of the same elements of electronic records, such as the medium, content, format, initiating actions and the people involved in the creation. Meanwhile, electronic records also allow for the consideration of additional factors such as metadata, which may help to determine time, date, place, and even revision history (MacNeil, 2000). In practice, however, such factors have often proven difficult to determine about content on the Internet. These methods also identify authenticity only at one specific point in time, and therefore cannot account for the fluid nature of Internet content (Roeder, Eppard, Underwood & Lauriault, 2008).

In summary, none of these proxies perfectly equates with accuracy; they merely suggest it. As a result, no combination of these criteria amounts to a foolproof means of identifying misinformation. Rather, information consumers are likely to consider that each or all of these criteria increases the probability of a proposition being true, so that more authority, credibility, trust, and authenticity, when combined, amount to a greater chance that the information is accurate. Caution is necessary in determining exactly how these criteria combine, however,

since the combination of concepts can result in circularities of definition, as for example, authority is partly defined as having credibility, credibility includes accuracy, and so on. Such terms are often used as synonyms, so we must be careful not to create artificial separations between them in order to combine concepts that are not entirely distinct.

Most importantly, accuracy is the only one of these criteria that aims to evaluate information itself. The other measures – authority, credibility, trust, and authenticity –are characteristics of information sources, not information content. In addition, while the research that studies how users evaluate these factors provides useful insight about important characteristics of information sources, it does not address the question of belief. Saying something like “I find this particular website credible because of factor A and factor B” is not the same as saying something like “I don’t believe this particular claim for reason A and B.” The former is a general impression of quality, while the latter is a specific judgment regarding truth or falsity. Existing studies of users’ evaluations enumerate evidence that users consider, but those studies insufficiently address *why* that evidence is preferred, and in particular why others might reject that same evidence. Also, on a macro level, such studies do not address the rejection of consensus belief. Nonetheless, they provide important building blocks in understanding the process of misinformation. The present study, therefore, can expand on this research by examining specific beliefs and the specific evidence considered to support them.

Vaccine Safety

There is considerable previous research about what people believe about vaccine safety (Alfredsson, Svensson, Trollfors & Borres, 2004; Atlani-Duault et al., 2015; Betsch et al., 2012; Brown et al., 2010; Casiday et al., 2006; Cassell et al., 2006; Dannetun, Tegnell, Hermansson & Giesecke, 2005; Davies et al., 2002; Downs et al., 2008; Evans et al., 2001; Gellatly, McVittie &

Tiliopoulos, 2005; Gellin, Maibach & Marcuse, 2000; Hilton, Hunt & Petticrew, 2007; Hilton, Petticrew & Hunt, 2006; Kata, 2010, 2012; LaClair, Smith & Woodward, 2014; Madden, Nan, Briones & Waks, 2012; Mills, Jadad, Ross & Wilson, 2005; Nagaraj, 2006; Nelson, 2010; Nicholson & Leask, 2012; Poland & Jacobson, 2001; Poltorak, Leach, Fairhead & Cassell, 2005; Ramsay, Yarwood, Lewis, Campbell & White, 2002; Saada, Lieu, Morain, Zikmund-Fisher & Wittenberg, 2014; Salmon et al., 2005; Serpell & Green, 2006; Venkatraman et al. 2015; Wolfe, Sharp & Lipsky, 2002; Woo et al., 2004; Zimmerman, et al., 2005).

Certain recurring themes emerge from these studies, about which more will be said in Chapter 4. The articulated reasons for negative attitudes toward vaccines include, among others, that vaccines contain dangerous chemicals, that children receive too many vaccines at once, that the risk of the vaccine is greater than the risk of the disease, and that the advice of medical professionals is compromised by relationships with pharmaceutical companies. Importantly, these studies identify what some people believe about vaccines, but not the reasons for those beliefs. They are studies of *what* is believed but not of *why* it is believed. In particular, these studies do not investigate the evidence their subjects consulted, nor the evaluation of that evidence. These studies therefore provide us with a nice basis of beliefs, leaving us to investigate the justification.

Fear of vaccinations is not a new phenomenon. A movement formed in opposition to the smallpox vaccine in the 19th century (Bellaby, 2003; Downs et al., 2008; Schwartz, 2012; Wolfe & Sharp, 2002). Some scholars have noted that the general concerns about vaccine safety have remained consistent throughout the history of vaccines (Schwartz; Wolfe & Sharp; Zimmerman et al., 2005). These include the idea that vaccination is unnatural, that it is unnecessary with

proper hygiene, that vaccines cause more harm than good, that vaccine science is not to be trusted, and that vaccine mandates violate civil liberties. As Schwartz puts it

The core arguments of critics of vaccination continue to parallel those expressed for nearly 200 years...What has changed are the ways in which parents, scientists, physicians, and others skeptical or critical of vaccines communicate and collaborate... today's critics of vaccines are part of national and international networks that have capitalized on the explosive growth of information technologies in the past quarter-century (p. 52).

Clearly, anti-vaccination sentiment predates the Internet, and even 20th century mass media. Nonetheless, studies of the relationship between the media and vaccine beliefs have shown compelling correlations (Smith, Ellenberg, Bell & Rubin, 2008) and that the media gives balance to vaccine-negative content disproportionate to popular sentiment and the scientific consensus (Schwartz, 2012). This is particularly true on the Internet (Betsch, 2011; Betsch et al., 2012; Betsch et al., 2010; Davies et al., 2002; Kata, 2012).

Vaccine resistance has certainly received prominent coverage in the media. Some attribute the modern anti-vaccination movement to a 1982 television program entitled “DPT: Vaccine Roulette” which apparently lowered DPT (diphtheria-pertussis-tetanus) vaccination rates (Kata, 2012; Schwartz, 2012). So many personal injury lawsuits ensued that vaccine manufacturers threatened to stop producing vaccines and the U.S. Congress created a separate vaccine court (Kata). In perhaps the highest profile recent appearance, in 2008 the actress and model Jenny McCarthy, the mother of a child once diagnosed with autism, appeared on CNN’s *Larry King Live* and *The Oprah Winfrey Show* advocating for vaccine reforms (Gross, 2009). That same year, she and her then-boyfriend, megastar Jim Carrey, led the “Green Our Vaccines”

rally (Brady & Dahle, 2008). During the 2009 outbreak of H1N1 “swine” flu, fears of the vaccine’s safety were the subject of frequent reports in the mainstream media. On September 26, 2009, the comedian Bill Maher tweeted, “If u get a swine flu shot ur an idiot” (Maher, 2009). In 2013, Katie Couric created a controversy by televising coverage of adverse reactions to the HPV vaccine that many criticized for having an unscientific bias (Couric, 2013). During the 2012 Presidential primary campaign, candidate Michele Bachmann called the HPV vaccine “dangerous” and linked it to mental retardation (Grady, 2011). Two expected Presidential candidates for the 2016 campaign, Rand Paul and Chris Christie, also expressed sympathy with vaccine concerns (Peralta, 2015). These are only among the most well-publicized expressions of such concerns.

In particular, refusal of the combined measles-mumps-rubella (MMR) vaccine has been prevalent for more than 15 years following the 1998 publication in the United Kingdom of a study that suggested a link between the MMR vaccine and autism (Wakefield et al., 1998), and the ensuing international media coverage (Kata, 2012; Schwartz, 2012). Notably, the Wakefield et al. paper itself states, “We did not prove an association between measles, mumps, and rubella vaccine and the syndrome described” (p. 641). Rather, it notes that parents of eight of the twelve children in the study reported a temporal association between the MMR vaccine and autism symptoms. Nonetheless, media coverage of the paper emphasized the link between vaccines and autism, as did Dr. Wakefield himself (Moore & Stilgoe, 2009).

Subsequently, a number of allegations of research misconduct were made against Andrew Wakefield, the lead author of the 1998 study. In 2004, a statement by the editors of *The Lancet*, the journal in which the Wakefield et al. study had appeared, detailed the various deficiencies (Horton, 2004a, 2004b). In the same issue, *The Lancet* published a retraction by most of the

original authors of the study (Wakefield himself did not retract) stating that, “no causal link was established between MMR vaccine and autism as the data were insufficient” (Murch et al., 2004). Subsequent investigations by the British Medical Journal found such significant misconduct, including fabricated data, that Wakefield has been stripped of his license to practice medicine (Dominus, 2011).

Since the 1998 Wakefield study, numerous studies have shown no relationship between the MMR vaccine and autism (Gerber & Offit, 2009). What initially aroused suspicion of a link between autism and environmental factors was data that from the 1980’s to the mid-1990’s, the rate of autism diagnosis increased nearly 400% (Miller & Reynolds, 2009). The most recent data predicts autism rates as high as 1 in 68 (Centers for Disease Control and Prevention [CDC], 2015). However, many doctors attribute this increase to a change in the definition and diagnosis of autism (Lingam et al., 2003). During the same period, the rate of MMR vaccination remained fairly constant (Miller & Reynolds). In Japan, incidences of autism increased even after the MMR vaccine was completely withdrawn (Honda, Shimizu & Rutter, 2005). The contrary evidence has not eliminated opposition to vaccines.

Although concerns about the MMR vaccine were well-publicized, there are other concerns about vaccines. Shortly after the publication of the Wakefield study, an additional hypothesis emerged about the use of thimerosal, a preservative that contains mercury in vaccines (Blaxill, Redwood & Bernard, 2004). Subsequent research has revealed that, while methylmercury can accumulate in the brain and damage it, thimerosal contains ethylmercury which is metabolized and cleared from the body without damage (Gerber & Offit, 2009; Gross, 2009; Miller & Reynolds, 2009; Offit & Coffin, 2003). The articulated mission of McCarthy’s “Green Our Vaccines” rally was to reform vaccine ingredients and the recommended schedule,

which is perceived as “too many, too soon.” These concerns with the schedule have themselves been refuted by scientific evidence (Gerber & Offit, 2009; Hilton et al., 2006).

One of the oldest objections to vaccination is resistance to government vaccine mandates. The first compulsory vaccination requirements began in 1853 and caused violent riots and the founding of anti-vaccination organizations (Wolfe & Sharp, 2002). According to Schwartz (2012) enforcement of such laws “disproportionately targeted the working-class and poor with fines and jail terms for noncompliance” (p. 51), which partly motivated an 1898 change in the laws allowed conscientious objection, the predecessor of the modern personal belief exemption to vaccine requirements (Schwartz). Today in the United States, all 50 states have vaccination mandates, but 48 allow exemptions based on religious beliefs, personal beliefs, or both (National Conference of State Legislatures, 2015). California currently allows exemptions for both reasons, but in the wake of the Disneyland measles outbreak, new legislation has been proposed to remove the exemptions (Pan & Allen, 2015). Interestingly, California is among the states whose mandates were successfully repealed in the 19th century (Wolfe & Sharp).

In recent years, vaccination rates have declined and vaccine-preventable diseases have increased, suggesting that many people remain unconvinced that vaccines are safe. Betsch (2011) notes that “as a consequence of suboptimal vaccination coverage the World Health Organization (WHO) failed to reach the goal to eliminate measles until 2010; the new target is measles elimination by 2015” (p. 1). In California, vaccination exemptions due to personal beliefs have reached record levels (Lin & Poindexter, 2009; Mohajer & Kumar, 2011). Simultaneously, California has also seen the highest number of measles cases in the United States (Gorman, 2011), even before the highly publicized outbreak of measles originating in Disneyland at the end of 2014. Since measles vaccinations began, reported measles infections in

the United States had decreased from about 500,000 cases and 500 deaths per year to a few dozen per year (Gross, 2009; Miller & Reynolds, 2009). Some cite a reduction of greater than 99% in reported cases in the U.S. due to the measles vaccine (Amanna & Slifka, 2005).

Overall, it appears that the scientific consensus has grown stronger while the acceptance of it has declined. In particular, the prevalence of vaccine skepticism in California makes this an ideal case for the study of misinformation. It involves a well-educated population rejecting scientific consensus, and is often concentrated in discrete pockets that make it easier to observe (Baum, 2014).

CHAPTER THREE

METHODOLOGY

Purpose of the Study

The findings of previous studies of beliefs about vaccines leave unanswered the question of how those beliefs are formed. How exactly does someone come to believe that vaccines are safe or dangerous? What information does that believer use, and how does he or she evaluate that information? Why does someone choose to believe one piece of information but not another?

The focus of the study has not been to determine the correctness or incorrectness of any particular information, belief or claim about vaccine safety. Rather, the focus has been to understand what people believe about vaccine safety, pro or con, and in particular how and why they believe it. Hence the study is based on four research questions:

Research Questions

RQ1: What evidence do people rely on for their beliefs about vaccine safety?

RQ2: What evidence about vaccine safety do they accept and what evidence do they reject?

RQ3: How do they account for their acceptance or rejection of any particular piece of evidence?

RQ4: What is the influence of the Internet on beliefs about vaccine safety?

Procedures

The study is based primarily upon a qualitative content analysis of information available on the Internet about vaccine safety, supplemented by exploratory interviews with parents of school-aged children about their own vaccine safety beliefs. The content analysis examined information publicly available on the Internet about vaccine safety, the evidence for and against

vaccine safety, and indications of how people with various vaccination beliefs have evaluated that evidence. In interviews, parents of children from two Los Angeles schools were asked to discuss their beliefs about vaccine safety and how they formed those beliefs. The interviews served to supplement the findings of the Internet analysis with original data collected offline and in live interaction with the author. Both the Internet data and the interviews included people holding pro-vaccination and anti-vaccination beliefs, including a spectrum of beliefs in between.

The focus of data analysis in this study was on the ways that people describe, evaluate and contextualize information that they present as evidence to support their beliefs. A major assumption here is that in online comments and arguments, people support their beliefs using the same sort of evidence that they find personally compelling and use in their offline interactions.

Definitions

The operationalization of terms for this study is rooted in preceding literature as discussed in Chapter 2.

“Belief” is defined as the treatment of a proposition as if it were true (Gilbert, 1991).

“Evaluate” is defined as assessing information to form or justify a belief.

“Evidence” is defined as that which is assessed in forming a belief.

To “accept” evidence means to decide that it is consistent with, supports or strengthens one’s own belief in a proposition.

To “reject” evidence means to decide that it is inconsistent with, does not support, weakens, or does not influence one’s own belief in a proposition.

Internet Thematic Analysis

Data Collection

The collection of Internet content employed an essentially purposive method, seeking data from the most relevant and accessible sources. Again, this data included both materials that support vaccination and vaccine safety and materials that oppose vaccination or question its safety. Because of the interest of this study in the influence of Internet-based information on beliefs, only Internet-based content on vaccine safety was collected and analyzed, rather than content from other media sources. Books, other print materials, broadcast programs and similar content on the subject were not included, except to the extent that such content is routinely available on the Internet to the average consumer. The principle of this collection strategy was to seek information using the same means that a typical Internet user is likely to employ when investigating the simple question, "Are vaccines safe?" Hence the collection did not include sophisticated strategies, lesser known tools, or academic literature inaccessible to the average consumer.

In August 2013, two searches were conducted using the Google search engine, one using the query "vaccine safety" and one using the query "vaccines autism." All links in the first three pages of results were followed, and the resulting web page was saved as HTML and printed to PDF. During analysis, this initial material was supplemented using a kind of Internet version of snowball sampling. When links within the original material appeared relevant, they were clicked and, if determined to be relevant, downloaded and printed to PDF. Likewise, many times when the original data referred to external sources that seemed relevant, those sources were retrieved, and when claims were unsubstantiated or unrefuted elsewhere in the data, additional material (e.g. medical websites) was consulted in order to understand the consensus and controversy

about those claims. During this “snowball” collection, material was added to the data corpus based entirely on the author’s perception of its relevance to the research questions.

This method resulted in the capture of 152 PDF files which were subsequently numbered consecutively. The captured data totaled more than 1500 pages and included formal websites of health organizations and advocacy organizations, blog entries, news articles, and an Amazon.com page for a book about vaccine safety, as well as a significant corpus of user comments.

The data collected in August 2013 stretches back several years before 2013, but also reflected current issues and controversies. At about the time of the data collection, two relevant news items were circulating through the Internet. The first was a court in Italy having ruled in favor of plaintiffs seeking compensation for vaccine damage. The second was the addition of Jenny McCarthy to the cast of the popular morning show “The View.” These topical news items were shared across several new sites and blogs in the data. While the prevalence of these items in the data may be overrepresented compared to data collected at different times, the tropes and themes identified during data analysis do not seem dependent upon these stories, since those same themes occur in earlier data, are common in previous literature (as discussed in Chapter 4) and have continued to be prominent in vaccine safety discourse up to and including subsequent developments such as the Disneyland measles outbreak around the end of 2014 (California Department of Public Health, 2015). While subsequent data has not been officially considered in this analysis, subsequent news developments have been monitored and determined to be consistent with the findings of this study.

Data Analysis

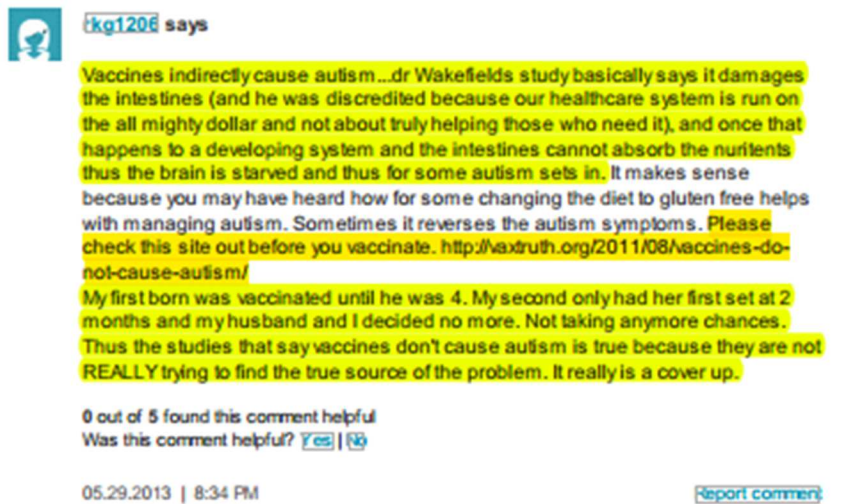
A thematic analysis was performed on the material collected from the Internet in four rounds. All analysis and categorizing were conducted by the author. One focus of the analysis was simply to identify the evidence itself. What evidence is cited? What beliefs does it support or refute? A second focus of analysis was to identify articulated reasons for accepting or rejecting any particular evidence. Particular attention was paid to refutations and disagreements, as well as to explicit citations of the sources of evidence.

The most interesting and illuminating data was found in the comments posted on websites by readers. Here, beliefs about vaccine safety are articulated and defended. The usefulness of user comments in addressing these research questions was not anticipated during the initial design of this study, but other researchers have observed their suitability for the exploration of similar issues (Jaspal, Nerlick & Koteyko, 2013; Shanahan, 2010). As Len-Rios, Bhandari and Medvedeva (2014) have noted

Because online commenters respond to science news using words that signify their beliefs about science and its practices, online comments are uniquely suitable for exploring how readers, through their cultural lenses, perceive the relationship among science, the individual, and society” (p. 779).

Also, while online comments do not illustrate the real-time process of forming any particular beliefs, they often contain evidence in support of beliefs. Given the classic definition of knowledge as “justified true belief” (Fallis, 2006; Furner, 2010), it seems appropriate to analyze online comments as examples of how people justify their beliefs, and thereby gain insight into their knowledge claims.

To this end, the first round of analysis highlighted two kinds of passages: those articulating or implying beliefs about vaccine safety and those articulating or implying means of evidence evaluation. These passages were marked regardless of whether they were pro-vaccine or anti-vaccine, and no such distinction was made at this stage. For example, this example from the data was highlighted as shown:



The highlighted areas reflect either a belief about vaccine safety (e.g. “Vaccines indirectly cause autism”) or a reason for a belief (e.g. “he was discredited because our healthcare system is run on the all mighty dollar.”) The area left unhighlighted was judged to be a digression from the topic of vaccine safety.

During this initial analysis, certain patterns began to emerge. Several categories of beliefs about vaccine safety – what people believe – were identified, as were several categories of evidence evaluation – how people believe. These same categories recurred over and over throughout the data.

During a second round of analysis, those passages highlighted in the first round were marked according to the identified categories. The categories are discussed in detail in Chapters 4 and 5. Beliefs identified in the data were as follows:

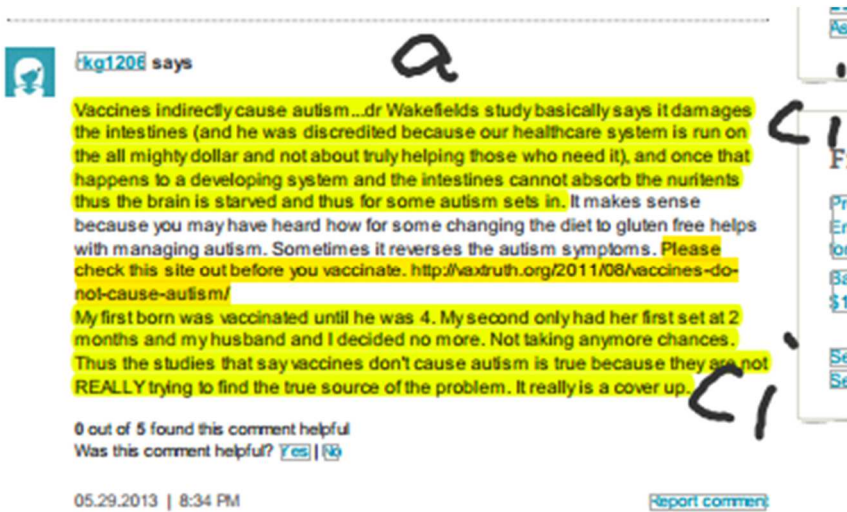
- A. Beliefs about the premise of vaccination
- B. Beliefs about toxicity
- C. Beliefs about what is “natural”
- D. Beliefs about cumulative effects
- E. Beliefs about compromised integrity
- F. Beliefs about civil liberties/civic responsibility
- G. Beliefs about autism:
 - a. Increasing diagnosis or change in definition of autism
 - b. Time at which symptoms appear
 - c. Genetic component

Evaluation strategies identified in the data were as follows:

- A. Authority
- B. Risk/benefit
- C. Personal experience and emotion
- D. Claims of self-evidence
- E. Reason

So, for example, if a passage articulated a belief that vaccine ingredients were toxic because of the number of shots given, it would be categorized as containing both beliefs about toxicity and beliefs about the cumulative effects of vaccines. If the passage then related an anecdote about the commenter’s child, it would be categorized as using personal experience as an evaluation

strategy. The example given above was categorized as containing beliefs about compromised integrity (“ci”) and the evaluation tactic of authority (“a”):



In addition to categories of belief and categories of evaluation, data analysis revealed a pattern of the use of similar evaluation tactics on opposing sides of the debate. Observations of this phenomenon were marked as a separate category in the data, in addition to being marked as whatever category of evaluation was exhibited. For example, when an Internet user cited scientific evidence in order to question the safety of vaccines, this passage was classified as an example of authority as an evaluation strategy and also as an example of the use of similar tactics on opposing sides of the debate, since a popular conception of the controversy is that scientific authority is only used in support of pro-vaccination beliefs. This use of similar tactics on opposing sides is discussed more thoroughly in Chapter 6.

Post type and size varied greatly, and thus a uniform measure of a single post was not possible. Some of the analyzed data appears in long blog posts or news articles, and some in user comments sections. Even within comments sections, some posts are paragraphs long and

some are merely a sentence. In addition, a single user comment may have multiple examples of a particular evaluation strategy. Therefore, there is no relationship between the number of times a category was identified and the number of users or of posts it represents.

A third round of analysis identified particularly illustrative quotations in the categorized data, noting the PDF and page number of particularly strong examples of each identified category. For example, fifteen specific quotations about the cumulative effects of vaccines were marked as being particularly good examples of those beliefs. Also, during this round, subtle variations within each theme became evident, such that citations to the data were grouped into subcategories under the main categories marked in round two. For example, passages that had been categorized as demonstrating beliefs about the cumulative effects of vaccines were further grouped into subthemes according to whether the concern was about combining multiple doses into a single shot or the receipt of too many vaccines at too young an age. Then, illustrative quotations were matched to each of those ingredients by citing the PDF number and page number. This resulted in the following section of the analysis table:

Cumulative effects	ce	
Combined doses		24.3, 123.1, 130.13-14, 130.18, 130.19, 132.19
Too many too soon		4.9, 16.7, 43.3, 69.13, 88.1-2, 100, 108.2, 110.27,

The gradations and variations within each category are elaborated in the analysis of results in Chapters 4 and 5.

As a final round of analysis, the illustrative quotations identified in the third round were marked as being pro-vaccine or anti-vaccine. For example, an anecdote about a child being vaccine-damaged would be categorized as anti-vaccine because it was used as evidence of the dangers of vaccines. Some examples were also eliminated at this stage as being inferior to other

examples. Accordingly, the examples identified in cumulative effects section of the analysis table were highlighted in green (pro-vaccine), red (anti-vaccine) or were eliminated (yellow.)

Cumulative effects	ce	
Combined doses		24.3, 123.1, 130.13-14, 130.18, 130.19, 132.19
Too many too soon		4.9, 16.7, 43.3, 69.13, 88.1-2, 100, 108.2, 110.27,

This enhanced the comparison of the use of each strategy on opposing sides of the debate.

Interviews

Recruitment

Interview subjects were parents of preschool and elementary school children and were recruited through schools in Los Angeles County. Recruitment and consent materials were approved by the UCLA Institutional Review Board (see Appendix A). Initially, schools were identified that had high rates of personal belief exemptions from state mandated vaccination levels. However, recruitment proved unexpectedly difficult. In September 2012, the materials were presented to the principals of the two schools with the highest exemption rates according to the public records of the California Department of Public Health. Both principals declined to distribute recruitment materials to the parents of any of their students. Subsequently, in October 2012, three additional schools with low exemption rates were approached. Two of them also declined to distribute materials to the parents of any of their students.

An administrator for the third school, a preschool in Malibu, California, agreed to distribute recruitment materials. The administrator also requested that she herself be able to participate, citing her own strong suspicions about the safety of vaccines. When she distributed the materials, no parents agreed to participate in the research. The administrator herself was the first interview subject, in the fall of 2012. After that interview, she personally contacted four mothers of students from the school, three of whom ultimately participated in interviews. The

administrator subsequently noted that she had selected mothers whom she knew to have diverse views on vaccination. One interview subject was strongly pro-vaccination, one was strongly anti-vaccination, and one had moderate views.

Given the difficulty in recruiting interview subjects, a sixth school was approached not based upon its vaccination rates, but rather based upon its core mission as a site for education research involving its students. At this school, three mothers consented to interviews. A few others expressed interest in participating, but then failed for unknown reasons to respond to scheduling requests. Interestingly, although the recruitment materials made no reference to the preferred gender, beliefs or vaccine status of participants, all three consenting participants were women with at least some degree of skepticism about the safety of vaccines.

In total, seven interviews were conducted between fall 2012 and spring 2013. All seven subjects were women, and only one had fully vaccinated her children in accordance with the recommended schedule.

Notably, other studies of beliefs about vaccine safety have encountered similar recruiting problems, including Moore and Stilgoe (2009) and LaClair et al. (2014), who state that, “Recruitment of parent participation in this study was more challenging than initially anticipated. It is likely that a lack of trust and a fear of stigmatization prevented other vaccine hesitant parents in the selected communities from stepping forward” (p. 32.) In contrast, many studies of vaccine safety beliefs cited in Chapter 2 successfully recruited participants in studies employing various methods, including interviews and focus groups. The difficulties in the present study may be attributable to the fact that the schools approached for the present study had been featured in various news articles about California vaccination rates, and thus their principals may have been unusually hesitant to participate in research on the subject. Principals and parents may

also have been reluctant to participate in what the recruitment materials clearly identified as doctoral student research.

Procedure

All interviews were conducted in person by the author and video recorded. The interviews were semi-structured around the three areas of interest: beliefs, evidence and evaluations. The interview instrument in Appendix B served as the basis for all of the interviews, although the order of subjects followed the natural flow of conversation rather than the order of the instrument, which served more as a checklist of subjects to address. The interviewer freely adjusted to the responses of the interview subjects, and explored whatever line of questioning arose that was relevant to the research concerns of this study.

Initial questions sought basic information and attitudes about vaccine safety. Once beliefs were identified, questions began to address the subject's reasons for those beliefs. Additional questions sought a general understanding of how parents might use the Internet to research vaccine safety. Of course, the interviewee did not observe parents actually searching. Rather, the questions were designed to get a sense of parents general search practices and how they retrospectively accounted for their current beliefs.

Analysis

Analysis of the interview data began at the conclusion of interviews in the spring of 2013, concurrently with the Internet content analysis. Because the issues and themes raised in the interviews corresponded broadly with those in the online content, a technique of detailed summarization (similar to that used to synopsise legal depositions), rather than verbatim transcription, was employed in the first round of interview analysis. These summaries included all of the content of the interviews, but concisely paraphrased that content. General time

signature information was also included. Using this technique, interviews of 60 to 90 minutes were summarized in an average of seven single-spaced pages each.

For example, the following verbatim quotation from an interview (which is discussed in Chapter 5),

And just like, you know, you put a fence up, “Oh no, I’m sorry, you can only look at the waterfall, you can’t go play in it,” well, you’re protecting them, but at the cost of their emotional and mental health. And it’s the same with the vaccine. You’re protecting them, protecting them, but at what cost?

was summarized in the first round of analysis as

Putting up a fence to say a child can only look at a waterfall but can’t go play in it protects children at the cost of their emotional and mental health. She thinks vaccines are the same, they protect children, but at what cost?

Once Internet data analysis was complete, the interview summaries were revisited in a second round of analysis, in light of the framework that emerged in the Internet data. The interview data was reevaluated in terms of its correspondence with themes and relationships in the Internet data. The themes in both data sources were generally consistent, although certain elaborations of some themes in the online data did appear in the interview summaries. In these cases, interview passages were transcribed verbatim to help illustrate the discussion of findings.

Limitations of the Study

The major limitation of the study is that it does not actually observe its subjects forming beliefs or evaluating information. Rather, it observes how Internet users retrospectively justify the beliefs they have. However, it seems reasonable to assume that subjects’ reasons for trusting particular information, and their opinion of that information, are similar now to what they were when they formed the belief. If the evaluation of the information had changed, it is likely that the belief itself would have changed. Thus we can draw inferences about belief formation by observing belief justification, and particularly the aspect of belief formation with which this

study is principally concerned, i.e. the use of evidence. The aspects of belief formation that this study has not observed—such as the progression from an unformed belief to a formed belief, or from disbelief to belief—are also not the aspects of belief formation about which this study is concerned. Furthermore, we must adopt some such proxy, since belief formation probably cannot be observed directly even by brain imaging technology. This is not a study of the evaluation of evidence at the first moment of evaluation; it is a study of the stance toward evidence for beliefs already held.

An additional limitation is that the sample observed may be biased toward the most opinionated, as they are the most likely to express their opinions on the Internet and to agree to interviews (Quandt, 2012). This is acceptable because the sources from which the data were collected are likely to be similar to sources from which people seek information about vaccines. The high accessibility of the data sources suggests a likely relationship to the popular discourse about the subject, and the data is consistent with previous research on the subject, as discussed in Chapter 4. Also, the beliefs in the collected data were quite diverse, including extreme views and more moderate ones. The most extreme beliefs, such as the belief that vaccination is a government plot for population control, were not among the most common beliefs in the data, and every effort has been made in data analysis to describe the most prevalent trends rather than outlying anomalies.

CHAPTER FOUR

WHAT PEOPLE BELIEVE ABOUT VACCINE SAFETY

Discussions about vaccine safety beliefs are often framed in binary terms as a disagreement between those who vaccinate and those who do not. Like most binaries, this framing oversimplifies a complex situation. While some people certainly reject all vaccines, others merely advocate for safety reforms. Still others have concerns about particular shots, the vaccination schedule, or other concerns. Some, of course, embrace wholeheartedly the safety and efficacy of vaccines and fully comply with doctors' recommendations. Rather than a simple conflict between vaccinators and "anti-vaxxers," the data collected for this study suggests a more nuanced view of vaccine safety beliefs. Not all of the subjects of the study share all of the same concerns. Some subjects overtly reject one concern but embrace another. At the same time, there are many beliefs that recur over and over in the data. While there are patterns and associations between certain beliefs, exceptions to those patterns are also common. Rather than adopting a pro-vaccination or anti-vaccination worldview, each believer seems to select from a group of beliefs those most compelling to him or her. It is as if available beliefs about vaccine safety were arrayed in a buffet from which each believer selects what he or she wants.

Most of the concerns that people have about vaccine safety relate to a fear that vaccines are toxic, a fear of the cumulative effect of vaccines, doubts about the premise of vaccination, or a fear about compromised integrity that obscures vaccine dangers. Those who fear that vaccines are toxic tend to worry either that the vaccine contains dangerous ingredients (such as mercury, aluminum or formaldehyde), or that the vaccine can cause health problems (such as autism). Those who fear the cumulative effect of vaccines worry either about the combination of multiple vaccines in one dose (such as measles-mumps-rubella or diphtheria-tetanus-pertussis) or about the increasingly large number of vaccines given to children at a young age. Those who question

the premise of vaccines believe that vaccines are ineffective, that the diseases they prevent are not serious, that those diseases diminished before there was a vaccine for them, that the vaccine can give them the disease it purports to cure (such as with the flu vaccine), or that unvaccinated people are healthier than vaccinated ones. Those concerned about compromised integrity tend to believe that vaccines are very profitable and that this profitability discourages manufacturers, doctors, and government agencies from fully investigating or revealing safety issues. Some also believe that interested parties hide the dangers of vaccines for fear of litigation, or even as part of a secret plan for population control.

Any particular person may have any combination of these beliefs. Some overtly reject one concern, such as mercury, while accepting another, such as giving a child too many vaccinations too young. Some embrace all vaccines, others reject them all, and still others make case-by-case decisions based on the characteristics of a particular shot and a particular disease. Some trust their own doctor but not the medical community as a whole, while others believe that even agencies such as the Centers for Disease Control, the Food and Drug Administration and the American Academy of Pediatrics are compromised by financial ties to the pharmaceutical industry. Some beliefs seem to coincide with others. For example, proponents of naturopathy and alternative medicine tend to fear the chemical ingredients of vaccines, while those distrustful of big corporations or of government institutions tend to worry about conflicts of interest and profit motives. Importantly, although such associations are observable in the data, this study has not attempted to calculate or otherwise investigate the strength of such correlations. Indeed, it appears that almost any combination of beliefs about vaccines can be found, even though the various combinations rarely if ever contain unique components.

The terminology that is usually used to describe vaccine safety beliefs often fails to capture the diversity of believers. In particular, the term "anti-vaccination," which is probably the most common term, is one that many people skeptical of vaccine safety dislike, in that it implies they reject all vaccines, rather than having concerns about certain vaccines or certain aspects of the vaccine program. In turn, many people with concerns about the safety of vaccines describe vaccine supporters as "vaccine bullies." In practice, many people insist that they are generally pro-vaccination while maintaining concerns about particular vaccines or about the schedule on which vaccines are given (Dannetun et al., 2005; Saada et al., 2014). Instead, those questioning vaccine safety often refer to themselves as non-vaccinators (who get no vaccines), selective vaccinators (who get some vaccines but not others) or delayed vaccinators (who get vaccines later than is recommended) while referring to those who comply with the recommendations of the American Academy of Pediatrics as "fully vaccinated." Needless to say, different beliefs motivate each of these different positions. The medical literature often refers to "vaccine hesitancy" and "vaccine hesitant parents" (LaClair et al., 2014; Saada et al., 2014; Schwartz, 2012). This term, however, suggests indecision or a pause in vaccination, connotations inapplicable to a great number of people's vaccine safety beliefs. Betsch (2011; Betsch et al., 2010; Betsch et al., 2012), refers to negative beliefs and those who hold them as "vaccine-critical." This term seems more aptly to allow for subtleties in negative beliefs about vaccine safety, but has no appropriate opposite in that "vaccine-uncritical" suggests a lack of thought that does not accurately describe many people who believe vaccines are safe. Other terms, such as "vaccine supporter" or "vaccine advocate," suggest a political stance for what is not always a political position. Likewise, the common term "vaccine compliant" describes behavior rather than belief, and mischaracterizes two groups of believers. First, people who

believe vaccines are safe may not be considered vaccine compliant if they have no children. Second, many parents who complied with the recommended vaccine schedule changed their views after what they perceived to be vaccine damage to their child. To the extent, therefore, that ease of reference requires us to divide the debate into two sides, we shall continue to use the common terminology of “pro-vaccination” and “anti-vaccination” with the caveat that these terms oversimplify a richly complex situation and describe only single beliefs and not necessarily any group of beliefs or the views of any particular believer.

There is considerable previous research, principally in the medical field, about what parents believe about vaccine safety. Numerous studies using various methods have been conducted in various countries investigating the reasons that people give for distrusting vaccines, especially the measles-mumps-rubella vaccine (Alfredsson et al., 2004; Brown et al., 2010; Casiday et al., 2006; Cassell et al., 2006; Danner, et al., 2005; Downs et al., 2008; Evans et al., 2001; Gellatly et al., 2005; Gellin et al., 2000; Hilton et al., 2007; Hilton et al., 2006; LaClair et al., 2014; Mills et al., 2005; Nagaraj, 2006; Poland & Jacobson, 2001; Poltorak et al., 2005; Ramsay et al., 2002; Saada, et al., 2014; Salmon et al., 2005; Serpell & Green, 2006; Woo et al., 2004).

There are also several studies of vaccination information and beliefs specifically on the Internet (Atlani-Duault et al., 2015; Betsch et al., 2012; Davies et al., 2002; Kata, 2010, 2012; Madden et al., 2012; Nelson, 2010; Nicholson & Leask, 2012; Venkatraman et al., 2015; Wolfe et al., 2002; Zimmerman, et al., 2005)

The findings of the present study are broadly consistent with those of previous studies. For ease of comparison to the present study, recurring tropes that emerge from previous studies are listed below.

A. Concerns about toxicity

1. The vaccine contains toxic or dangerous ingredients, such as thimerosal, aluminum, etc.
2. The vaccine can cause other diseases, such as autism or SIDS.
3. The vaccine causes pain or has other side effects.

B. Concerns about cumulative effects

1. Children receive too many vaccines, or receive them too soon.
2. It is dangerous to combine multiple vaccines into a single shot
3. Vaccines are a stress on a child's immune system.
4. The vaccine has other negative long term effects.

C. Concerns about the premise of immunization

1. It is better to develop immunity naturally by getting the disease.
2. The disease the vaccine prevents is not serious.
3. The vaccine can cause the disease it purports to cure.
4. The child cannot catch the disease because the child is healthy and/or lives in a healthy environment.
5. The vaccine does not protect from the disease, or the immunity is temporary.
6. Homeopathic or alternative medicine practices protect the child better than vaccines.
7. Proper nutrition or vitamins can replace vaccines.

D. Concerns about compromised integrity

1. Vaccine recommendations are motivated by quotas or other profit motives.
2. Vaccine recommendations are motivated by deals with drug companies.

3. Distrust of the government, official health agencies, or a bad experience with the health profession.
4. Vaccines are personal choices and refusal of them is a civil liberty.

Notably, Wolfe and Sharp (2002) have tracked anti-vaccination beliefs across history, and find most of the same beliefs recur throughout the history of vaccines. For example, 19th century complaints about the small pox vaccine included that it was worse than the disease and contained toxic chemicals, that compulsory vaccination denied parental rights, that profit was the main motivation, that the dangers were covered up, that immunity was temporary, that the vaccine was not effective, and that good health practices were more effective in preventing disease. Wolfe and Sharp document all of these beliefs in the 21st century as well.

Likewise, all of these beliefs recur repeatedly in the data collected for the present study. The most common themes in the present data are also common in the previous studies. While we shall ultimately distinguish variations in the beliefs above, as well as identify additional beliefs, the primary and most common tropes in this data are also the primary and most common tropes in previous studies. In broad terms, those tropes can be grouped into the categories used in the list above: beliefs about toxicity, beliefs about cumulative effects, beliefs about the premise of immunization, and beliefs about compromised integrity on the part of vaccine proponents.

Beliefs about Toxicity

An almost ubiquitous anti-vaccination concern, and hence one that vaccine proponents repeatedly attempt to refute, is the belief that vaccines contain toxic ingredients or components.

One extremely common belief in the present data is that dangerous ingredients are added to vaccines, as articulated in this comment on an article about vaccine safety⁴:

[4.1] Have you ever looked into the ingredients in the vaccines given to our children? The contain: formaldehyde, newly-declared carcinogenic by the FDA; aluminum, a neurotoxin; MSG, a neurotoxin; among other toxic preservatives. The levels of these toxins in some cases exceed the FDA's own standards for "safe levels." We are pumping these poisons into our children in the name of health? ... It is unconscionable to require parents to pump these toxic cocktails into their children, beginning at birth.

Note that this commenter uses the words "neurotoxin" (twice), "toxic" (twice), "toxins" and "poisons." The danger implied in these words is typical of anti-vaccination framing.

This is important to note because it is core to the belief being expressed. The mere presence of ingredients like aluminum and formaldehyde is not controversial as they are indeed present in many vaccines. What separates pro-vaccine from anti-vaccine stances is the belief that these ingredients are harmful in vaccines. As a commenter notes elsewhere:

[4.2] That's simply untrue – there are no "toxins" in vaccines at levels deemed harmful. Children get these same "toxins" in much higher levels in everyday life, and they don't suffer from that.

It is also important to distinguish a common and specific belief about vaccine toxicity, as suggested by this demand from a blogger:

[4.3] Could you please provide scientific justification as to how injecting a human being with a confirmed neurotoxin is beneficial to human health and prevents disease?

While the call for "scientific justification" is explored in Chapter 5, of note in this quotation, as well as in quotation 4.1 and throughout the data, is the use of the term "neurotoxin" which emphasizes not merely the toxicity of the substance, but its particular threat to the brain. It is probable that this is a legacy of the alleged connection between vaccines and autism, as the data

⁴ The quotations used herein are cut-and-pasted directly from the PDFs in the collected data. Any typographical or grammatical errors are from the original. Modifications to the original text are noted with ellipses or brackets as appropriate.

are rife with stories of brain damage that children suffer after receiving vaccines. This language suggests the very specific belief that the danger of vaccines is a neurological danger. While this is far from the only concern about the toxicity of vaccines, it is certainly prevalent.

These concerns about brain damage have particularly been associated with the use of mercury as a preservative in some vaccines. After the publication of the Wakefield study (Wakefield et al., 1998) concerns centered on the mercury content of the preservative thimerosal (Kennedy, 2005) that was used to prevent contamination of multi-dose vials that were punctured by numerous needles each time a new dose was drawn. While there seems to be no disagreement that mercury is toxic, pro-vaccine beliefs emphasize the safe dose in vaccines and the fact that it was never present in many vaccines (such as the MMR vaccine) and has been removed from most of the others:

[4.4] Since 2001, no Thimersoal has been in any vaccine's for children under 6 yrs of age. For older children and adults, the amount of Thimerosal in a multi-dose vial is equal to eating a small Tuna Fish sandwich. So, since thimerosal hasn't been in children's vaccines since 2001 and the Autism rate has grown, no one can blame the vaccine's that young infants under 6 get.

However, many people find these arguments unconvincing. Again, as is typical of vaccine safety beliefs, the reasons for concern about mercury in vaccines vary, though draw from a certain recurring set of beliefs:

[4.5] "The preservative in question isn't even used any more." It saddens me that press releases are still used as fact. Thimerosol preservative (ethyl mercury) is still used in seasonal flu and swine flu vaccines. It is still used in childhood vaccines and some antibiotics (ear drops) in "trace" amounts.

[4.6] Thimerosal? Why was it taken off the shelves if it wasn't the cause of autism? I don't understand? If it didn't harm children they should have left it. Something is up, and nobody is confessing.

These are not the only debates about the safety of mercury. Pro-vaccine beliefs also distinguish between ethylmercury, which was used in vaccines and has been shown to metabolize quickly and leave the body, and methylmercury, which is found in fish, does accumulate in the body, and is indeed known to be toxic. However, anti-vaccine beliefs do not find this distinction reassuring:

[4.7] I am a newly expectant mom, I have a 15 year old born on 1996, I did what I was told, had him vaccinated and he was SEVERELY damaged by the Ethel mercury in those vaccines. Mercury is mercury, it is an extremely dangerous neuro-toxin and should not be injected in an under developed immune system. Mercury attacks the central nervous system and the brain

In addition, Mercury is far from the only ingredient that is the subject of anti-vaccination beliefs. Another widely cited concern is the use of aluminum as an adjuvant to increase the immune response to some vaccines:

[4.8] Thimeresol was replaced with aluminum which is just as dangerous to the neurological system, possibly responsible for the continued rise in autism.

[4.9] The preservative in vaccines have aluminum. Babies who follow the CDC immunization schedule are injected with nearly 5000mcg of aluminum by 18 months of age! Scary thought? It's like injecting poison.

Pro-vaccination beliefs about aluminum are similar to those about mercury, and center on the idea that aluminum occurs naturally in our environment in much higher doses than those present in vaccines:

[4.10] Aluminum is the third most abundant element after oxygen and silicon, and it is the most abundant metal making up almost 9 percent of the earth's crust. Aluminum is found in plants, soil, water and air... While infants receive about 4.4 milligrams of aluminum in the first six months of life from vaccines, they receive more than that in their diet. Breast-fed infants ingest about 7 milligrams, formula-fed infants ingest about 38 milligrams, and infants who are fed soy formula ingest almost 117 milligrams of aluminum during the same period.

Notably, even this claim is the subject of anti-vaccination beliefs:

[4.11] However vaccine developers understand that a tiny amount of aluminum-salt, when injected as part of a vaccine, has very different properties from when ingested.

Of course, these are not the only concerns about the toxicity of vaccines. While mercury, aluminum and formaldehyde appear to be the most concerning ingredients, there are many others, which include aborted fetal tissue, monkey kidneys, animal DNA, cancer cells, and others. The concerns, furthermore, are not limited to the ingredients of vaccines, but to a general concern that vaccines do things to the human body that are harmful. Another manifestation of this is the belief that vaccines cause various illnesses and diseases. The diseases for which vaccines are sometimes blamed include cancer, diabetes, asthma, ADHD and others. The mechanism by which vaccines cause these diseases is usually either identified as one of the existing concerns about vaccines (such as toxic ingredients or the cumulative effect of them) or is left unexplained and, it is claimed, under-researched. This is true even of the best-researched of these beliefs, the claim that vaccines cause autism.

Autism

Despite the positions of the major medical organizations that vaccines do not cause autism, the data collected for this study is still rife with claims that thimerosal causes autism, that the MMR vaccine in particular causes autism, that the cumulative effect of vaccines causes autism, and many others. The CDC has tracked an increase in the diagnosis rates of autism from 1 in 150 in the year 2000 to 1 in 68 in 2010 (CDC, 2015). This increase is a central concern of those doubting the safety of vaccines:

[4.12] Common sense says there has to be a correlation...."Fastest-growing developmental disability; 1,148% growth rate" Vaccine schedule in 1983 - 10 vaccines. Vaccine schedule 2013 - 36-38.....huh! and we are seeing a growth rate of 1,148%!!!! THERE is your scientific research. Think for yourselves people.

On the other hand, many people attribute this increase to a change in the criteria for diagnosis in the last few years:

[4.13] Autism is on the rise because it is actually being diagnosed. 20,30,50 years ago, more than half these children would never have been diagnosed with autism. Now that we are learning more about autism of course more children will be diagnosed.

Nonetheless, even this is subject to the scrutiny of anti-vaccine beliefs:

[4.14] With all due respect, I was born in the 1950's and I can say emphatically that there WERE NOT that many "mentally deficient" people of ANY kind. Not 1 in 50, not 1 in 100, not 1 in 200. SOMETHING accounts for the radical increase in this kind of disorder, and I can assure you there has been a radical increase. You are reciting one of the favorite mantras of today's propaganda that vaccines and autism couldn't possibly be linked.

Another common belief specific to the relationship between vaccines and autism relates to the point at which symptoms of autism appear in children. Anti-vaccination beliefs tend to arise from the observation that the appearance of symptoms closely follows the receipt of the vaccine:

[4.15] How do you explain the countless examples of children who literally changed overnight immediately after receiving their inoculation? Coincidence?

Pro-vaccination beliefs, in contrast, see the coincidence of the vaccine and the appearance of symptoms as a correlation that does not suggest causation (a phrase they very frequently use themselves):

[4.16] its because autism with or without the vaccine shows its symptoms at about 18 months. your child will appear to be developing normally and at 18 months you will get the first symptoms the child may even deteriorate.

Another pro-vaccine belief specific to autism is that genetic components of autism have been identified in research:

[4.17] If you had done any research, you would know that autism is a genetic condition. They've already found the allele that causes it.

[4.18] If it's vaccines, then why are Boys are 5x more likely than girls?????

However, anti-vaccine ideas merely reframe this genetic component as a genetic predisposition that a vaccine can trigger:

[4.19] I don't know that the MMR vaccine was what caused her Autism. I do believe that the MMR vaccine reaction triggered something. Whether some carry a genetic trait/gene/trigger that predisposes them to Autism with the MMR vaccine being what flips that switch needs to be researched further. CAUSE or TRIGGER?

[4.20] I am a mom of 3 boys, my first developed autism within a couple weeks after his MMR vaccine.... my second son durastically changed within a couple weeks after his MMR shot... my youngest was due to get his today, I dodged that one as quick as I could! its obvious I have that gene that reacts with MMR vaccine and I know what will happen if he is givin that shot and I wont do that to him!

To summarize then, in this first category of vaccine safety beliefs – beliefs about toxicity – we find two principal emphases. The first is an emphasis on the ingredients of vaccines, primarily mercury and aluminum but also others. The second emphasis is on the effects of vaccines upon the body, particularly their believed responsibility for a number of diseases, most famously autism. Debates about the causes of autism, in turn, revolve around changes in diagnostic rates and criteria, timing of the appearance of symptoms, and whether autism is a genetic condition or results from a genetic predisposition for vaccine injury. While the present study has not attempted to quantify the prevalence of any particular beliefs, it is nearly self-evident that beliefs about toxicity would be the most common or at least among them. Indeed, in Kata's (2010) study of anti-vaccination websites, the only information that appeared on 100% of the websites studied were beliefs that vaccines contain poisons and that vaccines cause idiopathic illnesses.

Beliefs about Cumulative Effects

Another extremely common set of beliefs about vaccine safety has to do with the cumulative effects of combined shots or multiple shots and their perceived impact on the bodies of young children. Some people emphasize these beliefs more than others such as concerns about toxicity, while other people hold the combined belief that it is the cumulative effect of toxins that causes problems. Two different beliefs about cumulative effects are common in the collected data: beliefs about the safety of multiple vaccines combined into a single shot, and beliefs about the safety of the increased number of vaccines given to very young children.

The former of these beliefs, about the safety of combining vaccines for multiple diseases into a single shot, such as the measles-mumps-rubella vaccine (MMR) or the diphtheria-tetanus-pertussis vaccine (DTap), is less common in the collected data, but was once among the chief concerns about the relationship between the MMR vaccine and autism.

[4.21] There are no studies done on combination vaccines and how they react with one another. Not to mention any reactions with other environmental, drug or food chemicals or toxins.

This belief that the issue has been insufficiently researched is common in the debate. Indeed, as we shall discuss in Chapter 5, many believe vaccine safety is generally under-researched in many areas, not just with regard to combination vaccines. On the other hand, unsurprisingly, pro-vaccination views about combined doses include the belief that the research is sufficient and that the track record of such vaccines demonstrates their safety:

[4.22] The combination shot hasn't been used in Japan since 1993 and autism rates continued to rise. It's widely reported: [provides link]

Regardless of whether the lack of research is true, many people believe it, and often complain that vaccine policies fail to take their concerns into account:

[4.23] Why remove the choice of the single shots if parents are concerned about the MMR? So you then have parents that would do the shots in single form but not the MMR. If it was about ensuring herd immunity this is a bad policy. Thinking like this, can you blame parents for not trusting?

Note that in this quotation, which expresses a common sentiment, the commenter does seem to recognize the protections afforded by vaccines, so is not entirely “anti-vaccination.” Here, the concern is not with the overall safety of vaccines, but rather with the safety of a particular aspect of the vaccine and with the way the vaccine program has been implemented. (The concern with individual choice is also common, as we shall discuss later.) This is at the heart of the set of concerns about cumulative effects, which are premised on the idea that the vaccine program was safer in the past, but has now been compromised by combined doses and changes in the schedule.

In particular, this is the basis for the more commonly stated belief about the cumulative effects of vaccines that is often called the “too many, too soon” issue. The number of vaccines in the schedule recommended by the American Academy of Pediatrics has increased with the development of new vaccines and revised recommendations about existing vaccines. Reports of the size of this increase are inconsistent, and appear to depend on the time frame used and how vaccines are counted (whether by disease, dose, or number of shots.) The medical community justifies this increase as the advancement of immunology which is now able to prevent more diseases than it ever was before, and hence the increased number of vaccines means increased protection. Anti-vaccination beliefs, however, suggest that the increased number of shots can overwhelm the underdeveloped system of infants and toddlers, resulting in vaccine damage.

Consistent with a buffet arrangement of beliefs, “too many, too soon” beliefs have subtle variations. Most commonly, people express concern about the body being overloaded:

[4.24] My guess, and it's only a guess is that it's not so much the vaccines, as the mega cocktails of vaccines that children take these days. Could the body just need time and space to adjust to one vaccine at a time. It's only in recent years that these mega doses have been taken.

[4.25] ...pumping so many vaccines into a babies immature immune system! The current schedule is criminal, really, and people need to be held accountable for the damage it's caused to several generations of children.

Others suggest a connection between the increased number of vaccines and the rise in autism diagnoses:

[4.26] As all of my kids were growing up I knew of no other kids with autism & that generation only had about 8 vaccines. The current young ones are getting more than twice that number & the numbers of autistic kids is skyrocketing. Not only are there more vaccines, but, as much as 4 shots are given during one visit to the doctor. I have questioned many pediatricians & discovered there has never been a study done to prove that multiple vaccines given that way is not harmful.

Again, these kinds of beliefs are often adopted by a spectrum of people, some of whom reject vaccination entirely and some of whom otherwise accept its advantages and may even ultimately fully vaccinate their children:

[4.27] The problem is that they give them all too fast to close to each other and they do cocktails on top of them already being dangerous. I made sure they spaced my boys vaccines and I never allowed a cocktail because that changes the vaccine altogether.. I felt that helped and other moms have started doing this.

This idea of delaying vaccines is extremely common and those who engage in it often do not consider it to be anti-vaccination behavior. Many parents believe that in the first few years of life, before their child goes to preschool or kindergarten, the risk of infectious disease is low. They therefore adopt what they consider the precautionary measure of delaying infant vaccines with the intention that the child be "caught up" by the time he or she enrolls in school and socializes regularly with other children (Dannetun, et al., 2005; Saada, et al., 2014). This behavior is enhanced by the fact that most states' vaccination requirements apply to students

enrolling in schools. Notably, only certain kinds of families can take this approach, as households without a stay-at-home parent whose children are in daycare would presumably face greater risks from communicable diseases.

As we have seen, concerns about the cumulative effects of vaccines are most common as a motivation for selective vaccination or for delayed vaccination. Although full non-vaccinators often list cumulative effects among their concerns, such concerns by themselves seem insufficient to motivate a total rejection of vaccination. As a result, full non-vaccinators tend to have additional beliefs, including of course beliefs about toxicity. Another prevalent set of beliefs that seems to motivate a more comprehensive avoidance of vaccines are beliefs about the very premise of immunization itself.

Beliefs about the Premise of Immunization

Anti-vaccination beliefs about the premise of immunization include both beliefs about the vaccines and about the diseases the vaccines seek to prevent. Some people believe that vaccines are fundamentally ineffective, or are effective only for a short time. Interestingly, medical science agrees that vaccines vary in their effectiveness and longevity, and that none is 100% effective. The anti-vaccine stance toward this is that ineffective vaccines are not worth the risk, while the pro-vaccine stance considers this a reason to vaccinate as many people as possible. Another common anti-vaccination belief is that a vaccine can infect patients with the very disease it is intended to prevent, while the pro-vaccination belief is that vaccines confer immunity without infection. Anti-vaccination beliefs about the diseases themselves include that most vaccine preventable diseases are not a serious threat and that the effect of those diseases was already diminishing before the vaccine was introduced. This is often associated with a preference for options that are perceived to be more natural than vaccination. Pro-vaccination

beliefs, of course, tend to emphasize the threat of the diseases and that that threat has diminished because of vaccination. That some of these beliefs are contradictory is again typical of the complex belief profile that describes the information environment.

A primary area of disagreement about the safety of vaccines centers on their effectiveness. Some people doubt that vaccinations confer immunity at all (O’Shea, 2013). This belief is commonly supported by references to infection statistics:

[4.28] you need to educate yourself a little more.when there are outbreaks most of them include mostly vaccinated kids.duh.they must not work to well.

The effectiveness of vaccines is not necessarily a point of significant disagreement, as even the medical establishment acknowledges their limitations. As explained on the website of the World Health Organization (2015), “No vaccine is 100% effective.... For reasons related to the individual, not all vaccinated persons develop immunity. Most routine childhood vaccines are effective for 85% to 95% of recipients” (para. 2).

The disagreement arises as to how interpret this fact. The position of the CDC and other medical organizations relies on the concept of herd immunity, which is essentially that the more people who are vaccinated, the less likely it is that the disease can spread even to the unvaccinated or to those to whom the vaccine has not conferred immunity. As a consequence of this, those who believe in herd immunity believe that declining vaccination rates endanger more than just the unvaccinated, a belief which the unvaccinated openly reject:

[4.29] If the other kids are vaccinated and the vaccines are so great you don't have to worry about your child getting infected. This just proves your ignorance and that your vaccines are not all they are cracked up to be.

[4.30] If the others have had immunizations they shouldn't be infected, they should already have immunities built up from VACCINATIONS! So what are you worried about?

It is not always easy to distinguish whether such comments arise from ignorance that vaccines are not perfectly effective, or from a belief that their ineffectiveness is a reason not to get them, in contrast to the principle of herd immunity. Indeed, some argue that herd immunity is a myth (Blaylock, 2012). The core of this belief is that regardless of whether or not vaccines confer initial immunity, that immunity declines so rapidly that the majority of the population is effectively unvaccinated:

[4.31] The vaccination does not even fully protect from the disease. In fact, most children who get the disease were previously vaccinated. Most vaccinations are only good for an average of 7 years. I do not know any adult who gets vaxes every 7 years. Most don't ever get vaxed again after childhood.

[4.32] as “unvaccination” rates continue to rise... the ‘herd immunity’ concept will be increasingly less of an argument in support of the public health benefit and expenditure on mass vaccination schemes.

According to this belief, if most people are unvaccinated or under-vaccinated, then the decline in communicable diseases cannot be attributable to herd immunity or to immunization.

It is worth noting that a belief that vaccines are ineffective is, by itself, probably insufficient reason to decline a vaccine without some corresponding belief that vaccines are harmful. This is usually the case in the collected data where, in addition to concerns about toxicity and cumulative effects that we have already considered, some negative beliefs about vaccines relate to the premise of immunization as well.

One such anti-vaccination belief is that vaccines can infect people with the very disease they are intended to cure. This is a particularly common belief about flu vaccines, about which people who otherwise fully vaccinate nonetheless have concerns:

[4.33] Every year I got the flu shot I ended up sick as a dog, I haven't gotten the flu shot in 9 years.. I haven't been sick once and I have changed nothing in my daily life.

While this is most commonly associated with the flu vaccine, these beliefs are by no means exclusive to it:

[4.34] It is nuts to say that injecting a known sickness into an otherwise healthy child is 'good'.

[4.35] Its actually people who get these injections that create the more powerful versions [of the diseases]

[4.36] It should be the other way around where parents of unvaccinated kids should not b comfy letting their kids play wif ur vaccinated kids b'coz ur kids are carrying the "weakened form of virus".

Pro-vaccine beliefs, on the other hand distinguish between an immune response to a vaccine and actually getting the disease:

[4.37] I get the flu vaccine every year. Every year, I get a bit sick for a day or two after taking it — fatigue, headache, general don't-want-to-get-out-of-bed-itis. It's been explained to me by a nurse that what's happening is a general sort of immune response to having something shot into me — not the flu itself. So it can happen that the vaccine will make you "sick" — just sick in the sense that you don't feel great, not in the sense that you're actually infected with something that will kill you, or that can be passed along to another victim.

While these beliefs are similar to beliefs about toxicity in that they concern what is injected into the body, there is an important distinction. Beliefs about toxicity tend to concern the effects of substances added to the vaccines for various reasons. Beliefs such as those articulated in quotations 4.33 through 4.37 specifically concern the injection of the virus itself. That is, of course, the central concept underlying immunization.

There is also a general anti-vaccination belief that the diseases vaccinated for are not a threat. Sometimes, this is the belief that the chances of getting the diseases are so low that vaccination is unnecessary:

[4.38] very very very minimal chance of getting polio without the shot

Other times, it is the claim that even if one gets the disease, it is not dangerous:

[4.39] I was born in 1944. It was considered a normal part of childhood to contract measles, mumps, and chicken pox. They were not considered dangerous diseases. I never knew or heard personally of anyone who died of these diseases.

[4.40] ha ha ha! measles, mumps had them both. it was great. I got 3 weeks off school both times and got to go bowling with mom instead of school. Don't remember how sick I was. just being treated special and going bowling and no school! Bring it on! It was way better than getting Autism that's for sure!

As implied in this last quotation, many anti-vaccination beliefs view the premise of immunization as a choice between a mild disease that is very unlikely and a more serious, more likely harm from the vaccine:

[4.41] One person out of a thousand died from an outbreak of measles? Those odds are a lot better than putting every kid at risk for autism

[4.42] You are absolutely right. They are natural childhood diseases, there is nothing temporary or natural from Autism.

We shall explore the risk-benefit analysis at the heart of such beliefs in the next chapter. Related pro-vaccination beliefs, unsurprisingly, tend to emphasize the threat of the diseases and the fact that vaccination is the reason for their diminished impact on modern society:

[4.43] You know what's devastating? Measles, mumps, or rubella. Do some research about some of these horrible diseases.

[4.44] I grew up in the fiftys too. I also contracted all of the childhood diseases, measles, mumps, chickenpox etc. Something else happened to me in the fiftys. My father contracted Polio during the epidemic in the early 1950's and he DIED from it. He was a healthy, strapping, six foot tall 26 year old. He survived in a iron lung for 1 year before dying.

Another anti-vaccination belief that is perhaps more extreme but nonetheless rather common combines the belief that vaccines are ineffective with the belief that the diseases are

non-threatening by claiming that data shows the diseases diminishing before the introduction of vaccinations for them:

[4.45] FACT, diseases have ALWAYS ebbed and flowed before vaccines and continue to do so.

[4.46] Measles like all other childhood diseases was cleaned up 90% before the vaccines were being used... Clean water and good nutrition and sanitation, dropped childhood diseases by 90%

This claim is often supported on the Internet by graphs showing the steady decline of disease death rates over the course of the 20th century. The pro-vaccination criticism of that data is that it uses the wrong metric, as explained in the quotation below:

[4.47] That image shows death rates, not infection rates. Talk about cherry picking data. Immunizations aim to prevent infection, not cure those already infected. ... Mind you I have an open mind in regard to vaccinations not leading to the eradication of particular diseases. However, you would have to show prevalence of infection of said diseases over time, not death rates.

In the data collected for this study, there is rarely any anti-vaccination response to the distinction between incidence rates and death rates as a measure of vaccine effectiveness, but such opposition does exist, as in the following comment which seems to encapsulate the entire argument that immunization is not responsible for the declining threat of disease:

[4.48] This chart is one among 4 or 5 that all show disease decline long before vaccines were introduced. Yes it shows the death rate but if death rates decline it would follow that less people also were getting sick. Not only that but isn't one of the main reasons for taking vaccines is to prevent death from disease. If you can weather an infection and live your immunity will be the better for it. Vaccine immunity is weak an ineffective and why they want you to get boosters... The decline of disease across all parts of the world was due to better sanitation, the understanding of how disease is spread, and better nutrition. We no longer throw waste in the streets. People bathe and wash their hands regularly. We don't live virtually on top of each other. We eat a reasonably balanced diet with a basic understanding of nutrition and vitamins. This has caused the decline in all diseases including the ones that we have no vaccines for.

This comment also articulates a belief that is commonly associated with the belief that vaccines did not cause the decline in infectious disease. Specifically, it suggests that certain lifestyle choices have more effect on health than vaccinations do.

[4.49] I do not get the flu shot for my kids or myself. Considering that we are all healthy, live healthy, eat healthy individuals with no underlying conditions.... I don't see the need.

Other commenters take this emphasis on lifestyle choices even further:

[4.50] If you keep your child healthy from the start you won't HAVE TO WORRY about anything! Birth naturally, to prevent birth injuries and complications, keep your baby with you, breastfeed her, co-sleep to keep her safe and warm and reduces sids and makes breastfeeding easier, keep her free from vaccines, breastfeed her exclusively as long as possibly for the first year, let her eat foods when she is ready to do so herself, keep breastfeeding her, use breastmilk as medicine ... any illness keep breastfeeding, Your baby will be quite safe and healthy compared to most babies.

This exaltation of the natural is frequently associated with anti-vaccination beliefs. Even though this quotation seems to digress from anti-vaccination beliefs, these digressions are common elsewhere in the analyzed data, which is rife with examples anti-vaccination beliefs coinciding with natural lifestyles and alternative medicine practices. This often extends to a demonizing of the supposedly unnatural processes involved in vaccination, including its chemical components and the process of introducing something into the body artificially. Many even allege that the body's own immune system is superior to vaccination, which they perceive to disrupt the immune system rather than empower it:

[4.51] We don't need to be 'protected' from them ALL. Our natural immunity does its job quite well. It doesn't need to be exposed to diseases from other continents in order to maintain health.

[4.52] The power that made the body, heals the body; and I think we as a society are a little conceided by thinking that even with all the latest breakthroughs we're better able to fix/fight something we barely understand. Nature is wiser than us!

Pro-vaccination beliefs, however, emphasize that while vaccines are manmade, this does not make them dangerous or even unnatural:

[4.53] The argument is an odd one in that vaccines induce an immune response, so that it's the body's own "natural" immunity which is then primed to identify and fight any future pathogen exposure.

For many, this preference for natural immunity amounts to the overall impression that unvaccinated children are healthier than vaccinated ones:

[4.54] I was not vaccinated as a child... I always seemed healthier than my vaccinated peers, who were sick many times each year. I rarely became ill, and when I did get sick, I healed quickly, always without allopathic medicine. ... Today, I am a well-educated, healthy adult,

[4.55] The Un-vaccinated children such as my 5 grandchildren are healthy active and well balanced children. The vaccinated children are continually sick with runny noses, watery eyes, coughing, with fever and flu symptoms. Occurring over and over. When my grandchildren do get sick, it is a very mild case. They get over it quickly, their immune system is exercised and strengthened

In summary, beliefs about the premise of immunization relate both to vaccines themselves and to vaccine preventable diseases. People dispute the effectiveness of vaccines, both their initial ability to confer immunity and the duration the immunity lasts. Some also believe that the core principle of immunization – the injection of a dead or weakened virus in order to arouse the body's immune system – can result in the body actually being infected with the disease. Other beliefs relating to the diseases themselves include that the diseases are difficult to catch or are not harmful even if contracted. Such beliefs sometimes extend to denying that immunization is responsible for the diminished threat of the disease, attributing it instead to healthier lifestyles and natural health practices. All of these beliefs have in common some skepticism about the core principle of vaccination – that vaccines confer immunity and that immunity is necessary. While concerns about toxicity and cumulative effects are often discrete

problems that could at least potentially be corrected, these beliefs about the premise of immunization are part of a more profound disbelief in and disillusionment with the vaccine program, and often with the healthcare system in general.

Beliefs about Compromised Integrity

Such disillusionment with the healthcare system is an extremely common, and probably fundamental, belief about vaccine safety. There are many concerns about the integrity and reliability of the system that determines whether vaccines are safe. To varying degrees, such beliefs seem to underlie all other beliefs about vaccine safety, for in order to believe vaccines are safe, one must believe in the fundamental integrity of the system that declares their safety, a system that includes scientific research, medical professionals, government health organizations, and pharmaceutical companies. To doubt vaccine safety, one must doubt the overall integrity of such a system. Consistent with the “buffet” of variations and gradations of vaccine safety beliefs, the degree of one’s vaccine safety beliefs seems to relate to the degree of one’s belief in the system that evaluates vaccine safety. Those who accept vaccine safety tend to express belief in science, the advice of their own doctors, and the recommendations of agencies like the CDC, but they can nonetheless have criticisms of certain aspects of the system, while still believing that it functions correctly overall. Those who reject vaccines altogether may reject every facet of that system at every level, or may express faith in some components of the system while distrusting others, such as expressing belief in their own doctor but not the medical establishment, or a belief in science while rejecting the way science is practiced or the influence of external factors upon it. In particular, anti-vaccination beliefs tend to emphasize the corrupting influence of profit motives. The degree to which such motives corrupt, and what aspects of the system they corrupt in particular, varies among different believers.

The core belief about integrity has to do with the influence of money on the system of vaccine production and safety evaluation. Essentially, this is the belief that the first priority of the vaccine program is to make profits, and that all other priorities, including the safety and health of children, are compromised or discarded in service of the profit motive:

[4.56] LEADING CAUSE OF DEATH in this country is doctors and pharmaceuticals. What a huge cover up. I don't trust the medical industry they are all about the \$\$\$\$\$.

While the heart of such claims is financial conflicts of interest, there are subtle variations in how those conflicts are believed to be manifest. One belief is that the scientific research cannot be trusted because it is mostly sponsored or conducted by pharmaceutical companies that manufacture vaccines:

[4.57] Are we supposed to believe that the current medical paradigm is a beacon of objectivity? The fact is that vaccine manufacturers are not nonpartisan and neither is the science behind vaccines apolitical.

[4.58] The FDA actually allows the vaccine makers to do their own safety studies; they merely accept the results. Hundreds of individuals at the Centers for Disease Control and Prevention have conflict waivers because of their ties to the vaccine industry.

The second half of this latter comment suggests another variation on the conflict of interest theme, which is that the corruption is not limited to the research, but includes the entities supporting vaccines, such as the FDA, CDC, and AAP.

[4.59] vaccine manufacturers... will put pressure on the FDA to say that they are safe and the CDC to recommend them to the schedule.

Pro-vaccination beliefs view the economics differently, emphasizing the high cost of production as evidence that profits are not the controlling motivation behind vaccination:

[4.60] Yes, maybe you should follow the \$\$\$\$ and realize that vaccines produces large income and virtually no profit. These same pharmaceutical companies make the drugs and disposables used in treating infected people in hospitals and the standard profit ratio between treating one infected person and vaccinating one person is over 150,000 to one.

If you bothered to follow the money you would see that pharma companies do not want to sell vaccines and this has always been the case - most of them quit producing them in the '90s because there was so little profit in it. More profit is made on generic aspirin than DTaP and MMRII combined. Please, before you start shooting your mouths off please figure out the difference between revenue and profit.

[4.61] Even following your model of "money first", this is not a winning business strategy... there are many, MANY drug candidates that fail in Phase I and II clinical trials ... which is one of the reasons it costs so much. If hiding data is so prevalent (or standard practice for the industry), you'd expect a lot more drugs to pass - especially if having it fail can bankrupt the company. Yet even with these stakes, we see failures year after year, and countless companies bankrupted as a result.

Another variation of the compromised integrity theme is that vaccines are the subject of a cover-up. This is the belief that vaccine manufacturers, health agencies, and the medical community are aware of the safety problems with vaccines, but they would lose money if they admitted them:

[4.62] look who stands to financially suffer (oh, they'll NEVER admit this) if these programs for vaccinations are reexamined and curtailed. Even hint at a threat to an industry's paycheck and they will not stop pummeling you.

[4.63] These scientists [stay] blindfolded, as they sing Lalala with their fingers in their ears, their checks for pharma funding sticking out of their pockets.

Some extend the reach of this alleged cover-up beyond vaccine manufacturers and the medical community to implicate larger aspects of the information and media environment:

[4.64] Accurate data is not released through regular media outlets.

Such allegations are often compared to other scientific controversies, such as the unknown dangers of Thalidomide, or, particularly, the parallels between vaccine safety and tobacco safety:

[4.65] this is a biiger coverup then cigerates im pissed... the courts wont award anything the doctors cover it up too since they the ones actually giving the vaccines...

Pro-vaccination beliefs, on the other hand, seem to find the scale of such alleged conspiracies to be evidence against them:

[4.66] It is far more likely that a doctor or researcher that is looking for a little fame is not accurate than multiple agencies and the medical community are getting together to cover up evidence that vaccines can harm children.

There is, however, one extreme anti-vaccination belief that goes so far as to suggest not only that vaccine safety is exaggerated, but that dangers and the cover-up are intentional attempts at population control:

[4.67] Vaccines are bioweapons.

[4.68] VACCINES WERE CREATED TO DECREASE THE HUMAN POPULATION, & ITS WORKING. THE GOVERNMENT IS JUST STEPS CLOSER TO THEIR NEW WORLD ORDER... LOOK IT UP!!

Although such beliefs are extreme and uncommon, they are prevalent enough in the data to warrant identifying here. It is possible that beliefs of this extreme are articulated on the Internet disproportionately to their prevalence in the population.

Often, beliefs about compromised integrity are so strong as to imply that only those who are compromised would defend vaccination:

[4.69] why would you be defending these vaccines, are you part of the Bill Gates foundation or something? There is no legitimate reason to defend these criminals or their products of destruction and death unless you are either brainless or getting paid, and I checked your [YouTube] channel, you don't seem brainless.

[4.70] It sounds to me like you... are either a kickback taking doctor, a pharmaceutical representative, or one of the "herds" that has been brainwashed into believing all doctors are gods. Get a grip or get a brain.

Through the strength of the beliefs articulated here, compromised integrity emerges as the only explanation for beliefs in vaccine safety, implying that all other reasons, such as the consensus of medical research, are invalid or simply do not exist. This highlights the common theme running

through all beliefs about compromised integrity that the priorities of the vaccination program are misplaced. In particular, this implies that despite the declared primary intentions of the program, the health and safety of children are not its first priority.

It is important not to understate the importance of beliefs about compromised integrity as a motivation for anti-vaccination beliefs. It is difficult to find examples in the collected data of other anti-vaccination beliefs that are not stated concurrently with beliefs about compromised integrity. Indeed, even when such beliefs are not overtly stated, they are implicit in other beliefs which would seem to require an underlying distrust of the integrity of the health system. For example, beliefs about toxicity seem to require a belief that the medical community either is not aware of the toxicity of the vaccines, or is not concerned about it. The same is likely true of beliefs about the cumulative effect of vaccines, since to believe that vaccines are cumulatively harmful one must believe either that the medical community does not know or does not care. The former belief, that the medical community is not aware of the safety problems, would seem to require a dim view of the capabilities of the medical community. The latter belief, that the medical community is not concerned, seems to depend on one of two underlying explanations for the lack of concern. One underlying belief, that the medical community is not concerned because there is no reason to be concerned, would seem to motivate pro-vaccination beliefs. The opposite concern, that the medical community is not concerned even though there is a reason to be concerned, amounts to a belief in compromised integrity and would seem to motivate anti-vaccination beliefs. In a slightly different way, such beliefs seem to underlie anti-vaccination beliefs about the premise of immunization, since to allow for flaws in the premise one must believe either that the medical community does not sufficiently understand vaccination, or that it does understand vaccination but is not concerned about the flaws in the premise. Therefore,

while it may be an exaggeration to say that beliefs about compromised integrity underlie *all* anti-vaccination beliefs, it certainly seems as though an essential ingredient of anti-vaccination belief is the underlying belief that the medical community is incompetent or malevolent.

Beliefs about Civil Society

For many, this lack of faith in the healthcare system extends to a lack of faith in larger social institutions, including the government itself. Sometimes this is the political view that the government is corrupt or incompetent, but often it is a view about the responsibilities of people and institutions within societies. Rather than considering such beliefs in isolation, we might consider them a subset of beliefs about compromised integrity, because unlike other beliefs which are often combined but can easily be distinct, complaints about civil society seem to depend on some degree of distrust in the authorities the complaints are against. In other words, they depend on some degree of distrust in the respective institutions.

Probably as a consequence of the prevalent beliefs about conflicts of interest, a thread that runs through anti-vaccination beliefs is the view that individual concerns, particularly the concerns of parents, are insufficiently addressed. Many people with anti-vaccination beliefs feel that their concerns are not being taken seriously, but that they are instead being told what to do:

[4.71] One doctor told my sister he wouldn't see her son anymore if she opted not to get the vaccine. How dare he refuse her the right as a mother to not vaccinate *the way he wants her to*. [emphasis added]

[4.72] Trust us. We are hear to help. And pressure and force you to do with your kids, *what we want*. Yep, bad parents. Worried about their kids. ... then they were told, just get the shot and trust us. Think about it. [emphasis added]

Note the use in both quotations of phrases about what the doctor wants, which emphasize the dominance of the doctor's desires over those of the parent. This conflict is at the heart of concerns about vaccination programs. Given anti-vaccination concerns about toxicity,

vaccination schedules and compromised intentions, it is not surprising that many patients and parents are simply not comfortable letting someone else make healthcare decisions for them:

[4.73] We as parents should have the right to determine what is best for our children. This is a violation of our rights.

Such invocations of rights are common. Underlying many anti-vaccination beliefs is a general concern for civil liberties and individual choice. A principal focus of this concern is what many consider to be forced vaccination. One of the solutions proposed by those who fear declining vaccination rates is state-mandated vaccine compliance for children enrolled in school. Indeed, many states have such mandates, although all also allow various exemptions to them. Parents with anti-vaccination beliefs, however, view these mandates as a violation of their civil liberties. The two views of this issue are encapsulated in the following exchange from the comments on an article about vaccine safety, in which five different speakers replying to each other articulate opposing sides of the argument:

[4.74] Vaccinate your own child and let each parent decide. If your child is vaccinated, you have nothing to worry about. I don't know if you have kids but I feel that each parent has the right to decide what is best for their own child. You and the government need to mind your own business.

[4.75] [addressing 4.74] There are two problems here: 1) Society has to step in sometime, unless you believe parents should have the right to beat, torture and murder their children. If you believe society must step in, then we have the issue of irrational parents putting their children at risk of disease... And 2) your irrational beliefs are putting other people at risk of catching disease.

[4.76] [addressing 4.75] You have to be joking, right? It is a parent's responsibility to take care of their children how they see fit....Land of the free ring any bells? Parents get to decide what their child will eat, wear and what healthcare they will get. We aren't talking about torturing children!! Society has to step in sometime!?! INSANE. There are plenty of communist societies/Countries for you to exist in....please move to one

[4.77] [addressing 4.76] Not when the way they are treating their children is tantamount to child abuse. If you don't believe in vaccinating your children against deadly diseases, you should have to move to the middle of nowhere where your little plaguebearer can't hurt anyone else.

[4.78] [addressing 4.74] And what of the people who haven't had the vaccination? What of landed immigrants who were unable to get their vaccinations in their home third world country? What of older people, who have never been given the opportunity to get these shots...? It's a civic responsibility to make sure that people like you do as little damage as your misled quackery bullcrap can.

Both sides of the quoted conversation speak in terms of the responsibilities of a society regarding vaccination. Anti-vaccination views emphasize civil liberties, while pro-vaccination views emphasize civic duty. Anti-vaccination views emphasize individual choice, while pro-vaccination views emphasize an individual's obligation to others. In some sense then, an important undercurrent of many beliefs about vaccination may relate to beliefs about responsibility in a civil society. Anti-vaccination belief often suggests a reverence for individual responsibility to oneself, with emphasis on the need to do one's own research and the right to make one's own healthcare decisions. Pro-vaccination belief suggests a reverence for individual responsibility to others, with an emphasis on participation in vaccination for the greater good. Both sides of the debate, interestingly, seem to revere in different ways the responsibility of institutions to individuals, focusing on the intentions and priorities of healthcare institutions, or the responsibility of governments to protect our health and to ensure our freedom.

A Buffet of Beliefs

The quotations throughout this chapter have been isolated from their context in order to illustrate specific issues, but taken in their full context, and in the larger context of all articulated beliefs, they paint a much more nuanced picture than a "movement" of parents who reject vaccines for their children. Common explanations for anti-vaccination beliefs are that the

believers are ignorant, stupid or crazy. While we certainly find examples of each of those things in the data and elsewhere, we also find examples of ordinary parents to whom none of those descriptions would apply. If theorizing about misinformation on the Internet is correct (Floridi, 1996; Katz, 1998) we should not be surprised to find a group of parents, primarily concerned about the safety of their children, confronted by an information environment in which contradictory information is exceedingly easy to find. The ignorance that is often assumed to underlie anti-vaccination beliefs is certainly present, but not always, and can sometimes be explained by a lack of time or ability to fully research a topic, given the volume of material available. That same ignorance, and the presumed stupidity, is sometimes refuted by the depth of knowledge evident even among those holding anti-vaccination beliefs. Likewise, while many anti-vaccination beliefs may rise to a level of paranoia that most people cannot muster, few show evidence of pathological breaks with reality, and as we shall explore further in the next chapter, many people ground their beliefs in values, factual claims and personal experiences that are anything but delusional.

This does not, of course, imply the equivalency of any particular beliefs, nor is it intended to condone them. Rather, it emphasizes the multitude of different kinds of people that can draw upon the same basic set of beliefs in a multitude of different ways. In particular, it suggests that the existence of an “anti-vaccination” movement is complicated by various concerns of various strengths in various combinations. At the same time, the variations appear neither infinite nor disorderly, as they overwhelmingly draw on the few categories of belief we have explored in this chapter – about toxicity, cumulative effects, the premise of immunization, compromised integrity and civil liberties. Hence we describe the formation of vaccine safety beliefs using a buffet

metaphor. From a limited set of beliefs, each individual believer selects his or her own combination.

Some people seem to choose vaccines themselves on an item-by-item basis:

[4.79] The simple fact is that since the advent of vaccinations, the incidence of deadly and debilitating diseases has plummeted. But there are without a doubt risks. And there are vaccinations that are nearly pointless in my opinion...for instance chicken pox. Understand what you **should** and should **not** vaccinate against, and always read opposing sources of information to have a better shot at a realistic view.

This comment begins with the overt articulation of a pro-vaccination position, an embrace in fact of its core premise. The commenter then states a softly anti-vaccination position, that vaccines have risks, which is nonetheless consistent with the formal position of the medical community. The comment then elaborates the anti-vaccination belief by distinguishing some shots as “nearly pointless” and implying that there are some diseases worth the risk, and others that are not. It is difficult to describe this commenter’s overall position as either pro-vaccination or anti-vaccination. It is certainly inconsistent with the official recommendations of the CDC, while at the same time supporting vaccination in general terms.

This shot-by-shot evaluation of vaccine safety is quite prevalent in the data, and applies to various vaccines for various reasons.

[4.80] Ok. I'm cool with you not getting the Flu vaccination. I always believed that one was kind of BS anyway. But you should ABSOLUTELY be given a hard time with your children going to school without important vaccinations. I would not want mine or my friends' children going to school with kids who are unvaccinated just because a doctor who is clearly a quack and Jenny McCarthy told them vaccinations are the devil.

Other than the first two sentences, this comment is a strong endorsement of vaccination and an attack on anti-vaccination beliefs, their proponents, and the parents of unvaccinated children. At the same time, it is not a wholehearted embrace of the vaccination program nor of the premise of vaccination, given that it begins with a rejection of the flu vaccine. The rejection is also stronger

than a mere suggestion that it is unnecessary, but adopts at least the rhetorical strength of calling that vaccine “BS” (though we must not presume that this necessarily corresponds to a belief that the flu vaccine is a deception, despite the definition of “BS.”)

Note the level of knowledge and sophistication of understanding necessary for evaluations such as these. In order to hold such a belief, one must make distinctions between one vaccine and another. One must understand, at least to some extent, the individual characteristics of the particular vaccine and the disease associated with it, and the difference between the characteristics of each vaccine. Those concerned about mercury may be concerned about the flu shot, which contains it, but not about the MMR, which does not. Others concerned about cumulative effects might reject the MMR, while requesting an individual polio vaccine. Those concerned about the severity of diseases may vaccinate against measles but not chicken pox. This is a more sophisticated profile both of belief and of vaccine uptake than merely vaccinated and unvaccinated children.

Just as some people reject one vaccine without rejecting the entire vaccination program, so there are examples of people who reject a particular anti-vaccination belief while embracing other anti-vaccination beliefs. Take for example the following comment that rejects the connection between vaccines and autism while maintaining other fundamentally anti-vaccination views:

[4.81] I can tell you horror stories about vaccines all day long. What I'm saying is there's no connection between autism and vaccines. Are vaccine standards subpar? Yes. Do you risk getting the very infection you're trying to be immunized against with vaccines? You bet. Will you get Autism? No.

For this commenter, the rejection of autism as a concern does not alleviate the belief in “horror stories” or that the vaccine can cause the disease it seeks to prevent. Belief profiles like this one may have interesting implications for those seeking ways to counter anti-vaccination beliefs, as it

suggests that convincing a person about one issue does not amount to full support for vaccinations. An education campaign that debunks the connection between vaccines and autism, even if it is successful, would appear not to be effective in getting believers like this one to accept vaccination as a whole.

Merely assembling a list of beliefs does not give a full picture of the subtle configuration of beliefs, as different people draw different conclusions even from the same beliefs. The following two quotations are examples, like the quotation above, of someone rejecting one anti-vaccination belief while embracing another. Yet similar initial premises lead to essentially opposite positions:

[4.82] Thermisol is NOT THE CONCERN with vaccines. It used to be, but you get less thermisol in a vaccine than you do eating a couple of bites of salmon. Aluminum, however, is a major concern. Aluminum toxicity is known to cause autistic symptoms in healthy adults - that's what aluminum poisoning is

[4.83] There is more and more research out there, that it is not JUST the thermisol, it is the ALUMINUM contents in these shots that is dangerous. ... Vaccines in and of themselves and not detrimental to child's neurological health, it is the AMOUNT of vaccines at the YOUNG ages that are the real problem. With all the vaccines we currently give at 2 mths, the aluminum levels are heightened to a highly toxic level in that small amount of blood. ... I am a complete supporter of vaccines, one at a time, and/or at a later age. Vaccinate ALL you want, just do it smart

Both comments illustrate a rejection of one concern about vaccines (mercury) in favor of a different concern (aluminum), yet one appears to be essentially anti-vaccination and the other essentially pro-vaccination. Interestingly, the reference to salmon in the first comment (4.82) is a variation on a commonly used pro-vaccination example (as in quote 4.4), that there is more mercury in a single serving of fish than in a vaccine. Commenter 4.82 appears to be persuaded by the evidence that mercury is not a concern. At the same time, this does not amount to complete support of vaccines, as the alleged similarity between symptoms of heavy metal poisoning and autism are a commonly used anti-vaccination example. In the second comment

(4.83), we again see a rejection of mercury as a concern and an emphasis on aluminum, but note the layers of beliefs articulated here. This person appears to accept the premise of immunization, since he or she believes “vaccines in and of themselves and [*sic*] not detrimental,” but does have concerns about both the toxicity of vaccines and their cumulative effects, since it is “the amount of vaccines at the young ages that are the real problem.” In fact, here we see a combination of two anti-vaccination beliefs, that toxicity is the reason for negative cumulative effects.

Nonetheless, this commenter insists he or she is a “complete supporter of vaccines” despite caveats that are inconsistent with the official position of the medical community. As we have noted, it is common for anti-vaccination beliefs about cumulative effects to be associated with an overall acceptance of vaccines, and many parents with such beliefs fully vaccinate their children on a modified schedule. It is again difficult to know whether to consider such parents pro-vaccination or anti-vaccination.

Even when the general inclination of the beliefs is more clearly pro-vaccination or anti-vaccination, the belief profile may still be a mix of pro-vaccination and anti-vaccination beliefs. To define the anti-vaccination movement as the presence of anti-vaccination beliefs would overlook a number of people who appear to hold fundamentally pro-vaccination positions despite subscribing to certain anti-vaccination beliefs. For example, the following comment appears to have been posted to defend vaccine safety, and is in response to an anti-vaccination comment:

[4.84] lets see, polio, small pox, etc. stop being intellectually dishonest, and saying vaccines are all bad because they are not, especially when they dont have the preservatives and pumping all these vaccines into babies when they are younger.

Despite its pro-vaccination beginning, this comment qualifies the pro-vaccination belief with concerns about toxicity and cumulative effects, again underlining the difficulty of the binary distinction between pro- and anti- that often characterize the issue.

Taken as a whole, these comments and others like them in the data begin to suggest a relationship between certain categories of anti-vaccination belief and certain vaccine uptake behavior. While this study has not measured the strength of such correlations, it does present compelling evidence for further research into it. Denials of the premise of immunization seem to motivate the least uptake, which seems logical since such beliefs are by definition fundamental. Concerns about cumulative effects seem to motivate the adoption of alternative schedules, ultimately resulting in full vaccine uptake. Beliefs about toxicity and compromised integrity appear to be more complicated, motivating diverse vaccine uptake.

Some people consider toxicity a reason to forego vaccination entirely, as we have already seen in quote 4.1 above:

[4.1] ...We are pumping these poisons into our children in the name of health? ... It is unconscionable to require parents to pump these toxic cocktails into their children, beginning at birth.

Others lament toxicity as the one concern about an otherwise worthwhile program:

[4.85] my best information still says that vaccination is the best method to prevent catastrophic disease! We have no real choice here. I do wish that the companies would find other chemicals to go with the vaccine so as to end all this controversy.

Again, even beliefs that vaccines are toxic do not necessarily amount to ultimately being anti-vaccination. They may result in a complete rejection of vaccines, a call for reform, or a shot-by-shot evaluation based on individual ingredients.

Compromised integrity is also not necessarily a fully anti-vaccination belief. Many people have negative or suspicious opinions of pharmaceutical companies. This does not necessarily necessitate anti-vaccination views. For example, a woman posts this comment on a news article:

[4.86a] you cant go by the [National Health Service in the U.K.], they are always doing stupid shite, they aren't in the business of healing, they are money hording murderers.

The same woman then posts, only a few minutes later, this comment:

[4.86b] maybe you should look at how many children died before these vaccines came out. I work in nursing, you know how many old woman I have met who buried their baby cause they go one of these diseases and died.

In between the comments, this woman relates a story about her husband's medical care that has clearly left her with a negative view of the National Health Service in general, yet she is herself a healthcare professional and apparent supporter of vaccination.

There are many such examples. For those interested in increasing vaccination rates, a more sophisticated understanding of the buffet of vaccine safety beliefs may be instructive. At the same time, we must not overstate the diversity of beliefs about vaccines, since there is an organized movement with spokespeople and messaging that draws on all or most of the tropes we have identified. To the extent that there may be consistency among those advocates, however, it is consistency in information production. At the level of the individual believers, at least to the extent they express themselves on the Internet, the belief profile is subtler and more varied. Some certainly parrot the doctrine of the more formally organized elements of the movement and cite as their evidence some of the more organized information sources, but others make their way belief-by-belief through a contradictory and emotional array of selections, underscoring the individuality that is so often cited as characteristic of Web 2.0 (Witteman & Zikmund-Fisher, 2012).

Of course, this is an argument against generalizing, but even more than that it may say something fundamental about the complexity of belief profiles, perhaps even about how humans believe. While beliefs are often held in congruent systems, such as religions or political affiliations, it also seems likely that vaccine safety is not the only environment where beliefs are assembled using a buffet system. The Internet may even enhance such ways of knowing,

providing as it does a diversity of highly-accessible information (Floridi, 1996), in contrast to packaged belief systems propagated in narrower media environments such as those of churches and political parties (see Quandt, 2012).

This may also suggest something fundamental about misinformation on the Internet. Despite theories that the Internet's ease of production will flood the market with poor quality information, the information produced in the anti-vaccine environment is narrow, providing the limited buffet of choices. Still each individual believer consumes that buffet in his or her own way, underscoring that misinformation happens at the level of the believer. A small number of dishes can make a large number of unique meals. There is, in other words, more diversity in the consumption of this particular information than in its production. While it is far from demonstrative proof of such a thesis, the data collected for this study is certainly consistent with a view that misinformation is less a measure of what is produced than of how it is believed.

CHAPTER FIVE

HOW PEOPLE JUSTIFY THEIR BELIEFS ABOUT VACCINE SAFETY

In the interviews conducted for this study, all of the parents spoke of using the Internet to research vaccine safety. However, while it was often the first source they would consult, none of them seemed to use the Internet exclusively, but rather as part of a diversity of sources including books, news articles, their doctor, peers, and the observations of their own personal experience. Since the Internet itself is a complex collection of different sources, it is difficult to distinguish between online and offline evidence evaluation, such as whether someone's having read an article in the news meant reading it in a newspaper or on the Internet and indeed whether that distinction would matter. Given the small number of interviews here and the complexity of the media environment, we cannot draw firm conclusions about how people might use the Internet to form beliefs about vaccine safety. However, by studying the comments and other material that Internet users post, both to express their beliefs and to defend them, we might observe how people justify their beliefs. Given the classic definition of knowledge as "justified true belief" (Fallis, 2006; Furner, 2010), from this negotiation of belief justification way may at least make some inferences about how people evaluate evidence to acquire knowledge.

In the back-and-forth of comments sections, beliefs are often explicitly stated, as when commenters walk through the steps of their reasoning process, relay a personal experience that has convinced them, or cite some source or authority from which their belief derives. Other times, it is more implicit, as when an articulated belief relies upon assumptions that suggest the underlying evidence. Just as with the patterns of beliefs themselves, certain means of justification recur throughout the data, suggesting the widespread applicability of a small number of evaluation tactics.

Four primary categories were identified in the data as examples of how people believe: risk-benefit calculations, reason, personal experience, and authority. Like the complex buffet of beliefs themselves, the means by which people justify vaccine safety beliefs are not always distinct or exclusive. Rather they interrelate in complex ways. At the core of all such evaluations is a comparison of risks and benefits. This seems to be the fundamental consideration about vaccine safety. In turn, the risks and benefits in each situation are determined either by reasoning through evidence, by comparing evidence to personal experience, or by relying upon some authority. In turn, personal experience, particularly emotional experience, exerts considerable influence upon both reason and authority. Each evaluator might use one or more of these techniques in various combinations and to varying degrees, and the categories are not always distinct, as evaluators often use one category as a measure for the other, such as using reason or personal experience as criteria for evaluating authority. Nonetheless, it is instructive to tease apart these various criteria and their relationships to each other, as well as the ways in which the Internet may enhance and further complicate them.

Risk/Benefit

To understand how people evaluate vaccine safety we must first understand the fundamental evaluation that underlies every other tactic of evaluation—a calculation of risk and benefit. While the negotiation is often implicit, it is nonetheless so fundamental that it is difficult to find examples of vaccine safety evaluations that are not based on risk-benefit comparisons even if they are not overtly articulated. An evaluation of vaccine safety is an evaluation of the benefits of a vaccine compared to its risks, which in turn amounts to an evaluation of the risks of a vaccine-preventable disease compared to the risks of a vaccine. At the same time, a rich series of sub-calculations underlies this most basic balancing of options.

Those who determine that the risk of the disease is greater than the risk of the vaccine will of course tend to have pro-vaccination beliefs, such as in the following comment:

[5.1] Every child I will ever have will be vaccinated, even if there is a possibility of autism, even if it's strong, because I could never consider the chance of autism as more important than the life of my child.

Likewise, those viewing the risk of the vaccine as greater than the risk of the disease would tend to hold anti-vaccination beliefs, as in this example from Chapter 4:

[4.41] One person out of a thousand died from an outbreak of measles? Those odds are a lot better than putting every kid at risk for autism.

Where in Chapter 4 we understood this quotation to demonstrate skepticism about the premise of vaccination, and particularly a belief that the disease is not serious, we can note the risk-benefit calculation at its heart. Notably, regardless of which side of the safety debate a particular person ultimately finds compelling, the same negotiations support the belief.

Of course, the calculation is often more complicated than this most basic consideration of which risk is greater. As one example, those doubtful of the premise of vaccines may view the vaccine as ineffective, emphasizing not the risk of the vaccine so much as its lack of benefit. As another example, those with concerns about the cumulative effects of vaccines compare risks at various times, not merely pure risk per se. Likewise, as discussed in Chapter 4, the risks of different diseases are often weighed differently, and the risks of some vaccines are considered to be higher than others. Although the outcome of risk-benefit comparisons is ultimately binary—either they get the vaccine or not—the comparisons themselves are subtle, contextual, and highly individualized.

Some scholars have noted that risk-benefit calculations are different for vaccine safety than for many similar situations. To begin with, the calculation is different when one side is preventative rather than curative, because it involves intervention with a healthy person (Betsch,

2011). Hence, a healthy patient might view the side effects of vaccination as less desirable than a cancer patient might view the side effects of chemotherapy. Similarly, the options are between a presence and an absence, i.e. between the presence of a shot on one side and the absence of a disease on the other. Given this, vaccine hesitancy is, as Serpell and Green (2006) note, “understandable in terms of a tendency to favour acts of omission over acts of commission where risks are involved” (p. 4044). In other words, the present option can seem more threatening than the absent option:

[4.33] Every year I got the flu shot I ended up sick as a dog, I haven't gotten the flu shot in 9 years.. I haven't been sick once and I have changed nothing in my daily life.

Again, we examined this quotation in Chapter 4 as an example of the belief that vaccines can infect patients with the disease they seek to prevent. We can now see the risk-benefit calculation associated with that belief. The same influence of absence versus presence may increasingly apply, ironically, as incidence rates of vaccine-preventable diseases decline, due to “dilution of benefit” as described by Poland and Jacobson (2001): “As the widespread use of a vaccine diminishes or eliminates the risk of a disease, the public's perception of the vaccines' value paradoxically diminishes” (p. 2443).

Also mixed into the omission-commission negotiation is the influence of regret, as Brown et al. (2010) found. “Vaccine-acceptors,” they write, “anticipated regret from vaccinating and from not vaccinating with roughly equal frequency, whilst far more vaccine-decliners anticipated regret from vaccinating than from not vaccinating” (p. 4244). Here, the difference between pro-vaccine and anti-vaccine beliefs appears to depend on whether the believer anticipates regret from action or from inaction. As Serpell and Green (2006) put it:

People see events caused by their actions as their responsibility—and hence foresee feeling guilty if they go wrong. They do not always see events following from inaction

in the same light... If parents see potential [vaccine adverse effects] as their fault but [diseases] as acts of God they will be biased towards non-vaccination. (p. 4044).

Hence those anticipating regret from inaction appear more likely to hold pro-vaccination beliefs, as expressed in the collected data:

[5.2] As a parent I cannot imagine the regret I would feel if my child ever got a disease because I listened to morons on the internet.

Similarly, people feeling the regret of past action seem more likely to apply retrospective anti-vaccination interpretations:

[5.3] I feel tremendous guilt in knowing I allowed my daughter to be shot up with poison and I even helped in keeping her still to do so. How I wish I could go back in time and choose differently.

However, anticipated regret also motivates anti-vaccination belief, as many parents anticipate regret at injuring their child, as in the following quotation from an interview subject who believes that the chances of vaccine injury are slim, but nonetheless eschews most vaccines:

[5.4] You've done it to your child. You're the one who has brought them into the thing. It's not like a random disease that just hits them. You're the one who has done it to them. Even if you did it meaning well.

The deliberation between action and inaction is particularly striking here, where the mother apparently perceives her own culpability in having “done it to [the] child” with a vaccine as stronger than the inaction of a “random disease.” In these examples, the regret influences the prospective decision of whether to vaccinate (5.2 and 5.4) as well as the retrospective interpretation of injury (5.3).

At first, it may seem as though risk-benefit analyses cannot be retrospective, once previously hypothetical outcomes have become known. Many parents developed anti-vaccine beliefs after their child was vaccinated and had what they perceive to be a reaction to the vaccine. In some ways, this appears not to result from a risk-benefit analysis. On the other hand,

even once outcomes such as a diagnosis of autism are known, the causes are still uncertain. Parents who attribute their child's autism to a vaccine, therefore, are retrospectively reevaluating their initial risk-benefit comparison by increasing their interpretation of the costs. It may be useful to distinguish here between risk-benefit analyses, where risk is an assessment of an unknown future, and cost-benefit analyses, where cost is an assessment of the outcome of past action. Prospective risk-benefit evaluations appear to influence vaccine decision making, while retrospective cost-benefit evaluations appear to influence post-vaccine interpretations. The same retrospective evaluation might cause a parent who did not vaccinate to regret it when the child gets a vaccine-preventable disease. Logically, however, it would seem that retrospective cost-benefit evaluations only influence beliefs in cases of regret, for parents with healthy children will likely attribute health to having made the proper vaccination choice, rather than reevaluate it.

This suggests that time, too, is a notable component of the analysis, not only in terms of assessment of the future or reassessment of the past, but also to the extent that risk and benefits appear different at different times. Hall (2004) points out that the choice to adopt an innovation is often not between whether to adopt or not, but between whether to adopt now or defer the decision. Since a vaccine is an irreversible decision, many parents who question its safety undoubtedly elect to decline or defer the vaccine because that decision is the reversible one (Serpell & Green, 2006). A similar calculation is at the heart of the "too many, too soon" argument that children are given too many vaccines at a young age. The risks at a younger age, or before the child attends school, or when infection rates are low, may all seem different than they might at a different time.

The comparison is not limited to the risks and benefits of the various options, as often the very concept of safety itself is defined through a risk-benefit calculation. The Vaccine Education

Center on the website of The Children’s Hospital of Philadelphia (2013) cautions against defining safety as an absolute: “The first definition of the word safe is ‘harmless.’ This definition would imply that any negative consequence of a vaccine would make the vaccine unsafe. Using this definition, no vaccine is 100 percent safe” (para. 1). Indeed, some people in the data do define safety with exactly that expectation:

[5.5] what's interesting is the scientists and doctors cannot guarantee and PROVE that there is not a link between autism and vaccinations. Until they can do that, why would I want to even play with my child's health in that way. If there's even a one percent chance that they could be linked, that is too much for me.

As the CHOP website notes, this absolutist standard of safety is hard to meet, and we more routinely define safety through risk-benefit calculations:

[E]very year in the United States, 350 people are killed in bath- or shower-related accidents, 200 people are killed when food lodges in their windpipe, and 100 people are struck and killed by lightning. However, few of us consider eating solid food, taking a bath, or walking outside on a rainy day as unsafe activities. We just figure that the benefits of the activity clearly outweigh the risks.

While the CHOP website was captured in the data collected for this study, it does not contain user comments and therefore does not offer insight into how individual users evaluate its claims.

Nonetheless, some users in the data do express more or less the same concept of safety:

[5.6] They are safe, or rather, they are safer than many many other common medical procedures and medicines. Risk/benefit tells us that it's far better to vaccinate on schedule than to let nature decide when and how sick your children will be.

Thus the balancing of risk and benefit goes beyond a comparison of shot to disease in order to encapsulate the definition of safety itself.

Of course, if safety amounts to a lack of risk, it still may not tip a risk-benefit scale without some counterweighing benefit, as explained by this interview subject who rejects most vaccines as unnecessary, even if they are completely safe:

[5.7] Safety is not the only thing. Why do it? It's a need thing.

Here, what we identified in Chapter 4 as a rejection of the premise of vaccination, specifically that vaccines are unnecessary, is justified in terms of having little evidence for tipping the scale toward benefit.

Another factor that is important to vaccination in particular is weighing the risks and benefits to one's own child against the risks and benefits to society as a whole. As Serpell and Green (2006) have observed, "available information about risks is about *average* risk. What the parent wants to know is not what is the risk to children in general, but what is the risk to *their particular child*" (p. 4042, italics in original.) Some view vaccination as providing herd immunity for the benefit of entire populations of children:

[5.8] Frankly I think that those who choose not to vaccinate are putting a lot more people at risk than just your own child.

[4.77]. If you don't believe in vaccinating your children against deadly diseases, you should have to move to the middle of nowhere where your little plaguebearer can't hurt anyone else.

Others dislike the idea of endangering their own child in order to protect the population as a whole:

[5.9] they say that "small" risk of a handful of children is a risk that is worth it for all the people that are "saved" from disease. I wonder, would it be worth the risk to you if it were YOUR child that was unfortunate enough to have the fatal reaction? I wouldn't accept that my child should might die from a vaccine given to keep the rest of the population "safe"

[5.10] At this point I think Id rather take the chance that everyone eles will vaccinate their children and wait and see what does cause Autism.

This is one of many areas where “us versus them” conflicts arise in the vaccine safety debate. As we will discuss later, a similar contrast frames vaccine safety as a conflict between parents and pharmaceutical companies, and vaccine safety knowledge as a conflict between personal experience and impersonal data (Kata, 2010). This also highlights the conflict discussed in Chapter 4 between civil liberty and civic responsibility. Here again, the risk-benefit consideration is not merely a matter of the vaccine versus the disease, but a matter of whose interests should be protected among an assortment of players including parents, children, corporations, doctors, scientists and the greater good.

A somewhat paradoxical view of society’s role in the risk-benefit assessment implies that vaccinated children are not risking enough. This underlies the preference for natural methods discussed in Chapter 4 in its implication that the risk of vaccines is the risk of interfering with the natural order and flow of childhood and a child’s body:

[4.51] We don’t need to be ‘protected’ from them ALL. Our natural immunity does its job quite well. It doesn’t need to be exposed to diseases from other continents in order to maintain health.

Underlying this quote’s suggestion that children may be too “protected” is the idea that vaccines inhibit the body’s natural response:

[5.11] Vaccines suppress the natural immunity and the body does not have natural antibodies anymore.

Where others have blamed vaccination for injury, commenters like these now blame it for protection and suppression. In some sense, this is the opposite risk-benefit framing from vaccine injury concerns. Here the concern is that not risking diseases means not enjoying the benefits of natural immunity. In terms of risk-benefit calculations, these people view the risk of vaccines as going beyond the possibility of injury to a single child, but rather to increase all of society’s risk of getting diseases:

[5.12] polio was all but gone until they brought a vaccine out that started it up again, you do some research and come back to me

Indeed, the subject of one interview frames her choice not to vaccinate as a criticism of risk averse modern society:

[5.13] It's a culture now where you have to wrap your child in bubble wrap. You cannot let them take a risk anywhere... We're out there to enjoy our world, and part of that is taking risks. Now, I wouldn't say that, you know, 'Oh good, let's get sick.' But I think part of what a doctor's role is, is to protect at any cost, pretty much, your child. And just like, you know, you put a fence up, "Oh no, I'm sorry, you can only look at the waterfall, you can't go play in it," well, you're protecting them, but at the cost of their emotional and mental health. And it's the same with the vaccine. You're protecting them, protecting them, but at what cost?

Again this underscores that the negotiation is not simply between a risky disease and a beneficial vaccine, but sometimes even the opposite—a risky vaccine and a beneficial disease. While a rudimentary understanding might expect anti-vaccination beliefs to be risk averse, those exalting natural immunity and natural experience often consider the risk averse ones to be the vaccinated.

Overall, therefore, comparisons between risk and benefit arise from considerations of myriad factors. The most basic comparison of a disease to a shot depends on contextual evaluations of multiple factors. Particularly relevant to evaluations of vaccine safety are considerations of omission versus commission and the needs of individuals versus societies, which are in turn influenced by considerations of regret (experienced or anticipated), timing, and the very definition of safety.

To the extent that the Internet may play some role in such negotiations, we may presume that people researching vaccine safety on the Internet would seek information regarding the degree of the respective risks. It is therefore notable that Betsch et al. (2010) found that, compared to controls, anti-vaccination websites increased users' perceptions of the risk of vaccinating and decreased their perception of the risk of not vaccinating. We should not

presume that this finding is specific to the Internet, however, as it may result from exposure to similar information in any medium. On the other hand, Downs et al. (2008) found that 93% of their respondents said they would use the Internet to search for information, and that same percentage would find anti-vaccination websites in the first 10 results, which were more commonly found using simple search terms than precise ones, suggesting that anti-vaccination websites “might be most accessible to individuals with the least knowledge” about vaccines (p. 1604; also Betsch, 2011.) Hence the keyword-based algorithms of most Internet search engines may overrepresent vaccination risks compared to the vaccine benefits that are the popular and scientific consensus. Importantly, recent changes to the Google search algorithm now include more medical “facts” in search results (Ramaswami, 2015). Some have already seen evidence that anti-vaccination search results are less prominently ranked (Plait, 2015). Also, future algorithmic updates may rank information based on facts rather than links (Dong et al., 2015). However, since these changes are new and not universal to all search engines, it is still likely that the Internet overrepresented risk to the people represented in the data collected for this study.

Once we understand risk-benefit as the basic evaluation, we can expand upon it to understand specific techniques people use to evaluate risks and benefits. Consider the many calculations and assumptions that underlie the following conversation:

[5.14] how many of you would raise your hands and honestly say...I would take the chance of giving my child Autism as long as they get the MMR vaccine? only someone who has a vested interest in the programs longevity would respond 'yes'

[5.15] [responds to 5.14] I would and I have. My son didn't get it from MMR, he had it since birth. I would rather him be autistic then risk him contracting a disease that could be worse on his body and potentially harm hundreds of people because I chose not to vaccinate him, he could even die, why risk that on others, and put the public at RISK, I am in the medical field and until you see what diseases and polio, measles, mumps and rubella can do to babies and young at risk kids with other health issues, I wouldn't be so quick to assume or say it's the MMR vaccine.

[5.16] [responds to 5.15] REALLY!?! You would rather your child be autistic than putting the public at risk. WOW! I wonder what your child would have chosen.

The risks articulated or implied in this conversation are: the risk of autism, the risk of disease, the risk to others, the risk of death, the risk to the public, and the risk to children. The benefits considered are: the benefit of avoiding the MMR, the benefit to “the programs longevity,” the benefit of preventing disease, the benefit to the public, and the benefit to children. In turn, each comparison of these risks to these benefits relies upon an assortment of beliefs and assumptions that inform the negotiation. Quotation 5.14, for example, relies upon the assumption that the MMR vaccine has a chance of causing autism, and that pro-vaccination beliefs could only be motivated by a “vested interest in the program.” Quotation 5.15 relies upon the assumption that autism is detectable at birth, that vaccine-preventable diseases are worse than autism, that non-vaccination harms others, and that vaccines can prevent the diseases, among others. Quotation 5.16 relies upon the assumption that one’s own child’s well-being is more important than society, and indeed that one is risking either the child or society rather than helping both. Notably, each of these assumptions is challenged in the collected data, as discussed in Chapter 4.

Understanding them as a risk-benefit analysis, furthermore, does not explain the underlying assumptions on which they are based. Hence to fully understand the justification of belief through risk-benefit analysis, one must also understand the origin of the beliefs that support each side of the risk-benefit ledger.

The collected data offers suggestions of how each believer arrived at those underlying assumptions. The first such technique is endemic to risk-benefit analyses, which are implicitly a claim to having reasoned one’s way through the evidence toward the proper conclusion about vaccine safety.

Reason

People who do not object to vaccines (which are most people, Raja & Mooney, 2014) might intuitively think of vaccine safety beliefs as a matter of reason. The popular framing of opposing vaccination beliefs often represents the debate in terms of the rational compared to the irrational, the informed compared to the uninformed, or even the sane compared to the crazy. Interestingly, each side claims rationality for itself and attributes irrationality to the other. Regardless of the ultimate conclusion, reason is commonly exalted as an essential tool for proper evaluation of vaccine safety, and its application is presumed to reveal the right conclusion.

The use of the term “reason” to describe this evaluation tactic does not imply reasonableness, nor is it the same as “having reasons.” Rather, it is intended to describe a particular means of using evidence in which beliefs are attributed to rational processes such as logic. As a category, reason is not always discrete, since risk-benefit calculations, for example, are themselves a form of reasoning. Likewise, as we shall discuss shortly, the use of “pure” reason is complicated by emotional, social and cultural influences. Nonetheless, it does seem worth examining this evaluation tactic separately, since recurrent in the data are examples of people justifying their beliefs in the terminology of rationality, regardless of whether others might consider that reasoning to be biased or otherwise flawed. There are several ways in which people justify their vaccine safety beliefs using reason, including basic inference from premises, correlation, and a reliance on published science.

Those for whom reason is an identifiable source of their beliefs often adopt inferential language structures to demonstrate the drawing of conclusions from premises. Note, for example, the if-then inferences articulated in the following quotations:

[4.18] If it's vaccines, then why are Boys are 5x more likely than girls [to have autism]?????

[5.17] why is there a compensation fund for vaccine injured children and a website specifically to report adverse reactions if it never happens.

While most inferences are less explicitly stated, the data is rife with such examples of commenters supporting their beliefs by framing them as reasonable conclusions.

Often the inference is based on correlation, as in this example from Chapter 4:

[4.12] Common sense says there has to be a correlation...."Fastest-growing developmental disability; 1,148% growth rate [of autism cases]." Vaccine schedule in 1983 - 10 vaccines. Vaccine schedule 2013 - 36-38.....huh! and we are seeing a growth rate of 1,148%!!!! THERE is your scientific research. Think for yourselves people.

Here, the overt claim to “common sense,” the reference to “correlation” and the comparison to “scientific research” all make the appeal to reason explicit. But most telling is the final sentence’s invitation to “Think for yourselves,” which implies the belief that thought leads to truth, and what’s more, that that thought must be independent and critical. Indeed, critical thinking is seen on opposing sides of the debate as essential to truthful understanding, as if to imply that without proper reason one cannot know the truth about vaccine safety.

Other commenters call upon the conclusions of science, with its roots in rationalism and deduction from evidence, to support their vaccine safety beliefs:

[5.18] here's a great study of half a million danish, a good section were not vaccinated- generally the same rates [of autism].

[5.19] i can make a fucking correlation between banana consumption and autism if i wanted to. I would like some real, solid science before you maniacs kill off more people.

[4.3] Could you please provide scientific justification as to how injecting a human being with a confirmed neurotoxin is beneficial to human health and prevents disease?

[4.21] There are no studies done on combination vaccines and how they react with one another. Not to mention any reactions with other environmental, drug or food chemicals or toxins.

As discussed in Chapter 4, some people overtly reject science as a uselessly compromised way of knowing, but others on opposing sides of the debate do rely upon it, which implies a reliance on its deduction from evidence. Notably, scientific evidence is not the only kind of evidence supporting vaccine safety beliefs, as many also rely upon the findings of courts:

[5.20] a fact that (vaccines cause autism) has been admitted by the USVaccine Court. About 83 suspected cases of vaccines causing autism have been awarded compensation.

[5.21] My question to you is... how is it junk science when mothers and fathers have won lawsuits based off of evidence that these vaccines DO IN FACT cause Autism??? The court would not give them over a million dollars if there was no evidence supporting the claims. That evidence is called SCIENCE not "junk science"

[5.22] the courts are full of lawyers, NOT Scientific experts

Although the kinds of evidence and the sources of evidence vary from believer to believer, the underlying process of reasoning from evidence underlies these beliefs.

Reason is not only used as a means of supporting belief, but is also quite commonly used to dismiss beliefs from the other side of the debate, as in quotations 5.21 and 5.22 above (among others) and the following:

[5.23] Correlation is not causation. I also bet your child ate something the day that they started to 'change,' perhaps you could go on a witch hunt and blame that food product for autism as well.

In particular, advocates of one position tend to attribute the other position to reasoning flaws.

Colloquially, the attributed flaws include stupidity and insanity, as in quotation 5.19 above (and 4.69 and 4.70 in Chapter 4), but are also framed in more sophisticated, science-evoking language like “correlation is not causation” in quotation 5.23. In scholarship, many apply taxonomies of reasoning flaws to explain misinformed belief (Gilovich, 1991; Shermer, 2011). Jacobson, Targonski and Poland (2007) apply Gilovich’s taxonomy specifically to anti-vaccine beliefs. They examine preferences for predictability over randomness, the use of flawed data, wishful

thinking, miscommunication, and “exaggerated impressions of social support” (p. 3147). The present study, however, does not seek to judge the correctness or incorrectness of the application of reason, so much as to describe the means of its application. Taxonomies of errors are therefore of limited use in addressing our research questions.

One commonly cited explanation for belief in misinformation that may be of use, however, is the influence of bias. Although bias is also considered an error, it does shed light on our research questions by suggesting influences on the evaluation of factual claims, and what may cause a preference for one factual claim over another. We have already explored in Chapter 4 how bias is sometimes used to dismiss the claims of others who are perceived to be biased. The collected data also provides evidence of bias influencing one’s own interpretation of evidence. In particular, the data provides some evidence of *motivated reasoning* and *confirmation bias*, which refer to a believer’s tendency to evaluate information in a way that confirms what they already believe (Hart et al., 2009; Kuklinski et al., 2000; Poltorak et al., 2005) and to resist correction (Lewandowsky et al, 2012; Nyhan & Reifler, 2010; Nyhan, Reifler, Richey & Freed, 2014). As discussed in Chapter 4, vaccine skeptics see financial conflicts of interest as motivating pro-vaccine reasoning. What may motivate vaccine safety reasoning—both positive and negative—is the somewhat more complicated interplay of reason and emotion.

Motivated Reasoning

A recent meta-analysis (Hart et al., 2009) found that people were nearly twice as likely to select information that confirmed their beliefs as information that challenged them. Similarly, Kuklinski et al., (2000) found that people tended to resist facts that contradicted their firmly held beliefs, and Nyhan and Reifler (2010) found that the misinformed resisted correction to their

beliefs, and often the correction made them even more likely to believe the misinformation. They later investigated corrections specifically about vaccine safety, and discovered that none of the corrections were effective in changing beliefs (Nyhan et al., 2014). Even those presented with evidence from both sides of an issue tend to uncritically accept the confirmations while expending extra effort to justify and discount the contradictions (Munro, 2010). Most strikingly, as Kuklinski et al., discovered, “those holding the least accurate beliefs perversely expressed the highest confidence in them” (p. 798). Interestingly, one study of parents opinions toward vaccines (Poltorak et al., 2005) found that “only those mothers who researched to support a previously felt position ended up making a decision they felt clear about,” (p. 715). The influence of preexisting beliefs on the evaluation of evidence may be one of the best studied aspects of belief formation.

Of course, such behavior would account for the Internet’s echo chamber effects (Pariser, 2011; Sunstein, 2007), suggesting that the filtering out of contradictory information may not be a new phenomenon, but merely the technological empowerment of a preexisting human tendency. Other researchers, however, (Garrett, 2009; Jang, 2014) find that an Internet users’ selective exposure to information that cocoons them in echo chambers may have been overstated. Instead, Garrett found that while participants in his study did seek information that reinforced their beliefs, they did not avoid information that challenged it. Hence the process of information search and retrieval appears to be more complicated than merely selective exposure, emphasizing the question of how individuals translate confirming and disconfirming evidence into individualized belief.

While such effects have usually been observed in psychology experiments utilizing methods that the present study does not employ, we are nonetheless able to observe in the

collected data some examples consistent with those findings. For example, in both Internet data and in interviews people doubting vaccine safety complained about not being able to find sources that tell “both sides.” On one hand, this would seem to be evidence that people do seek confirming and disconfirming evidence. On the other hand, it does not appear to be a common complaint among those convinced of the safety of vaccines. It may actually be a lament that those with anti-vaccination beliefs are not finding as much confirmatory evidence as they would like. This suggests that the reason mainstream medical sources are not considered legitimate may be because they are inconsistent with minds already made up.

As another example, consider the predisposition articulated in the following comment:

[5.24] We put off letting our son having the MMR until he was 18 months old through fear and then it was reported that Dr Wakefield was scaremongering and that there was no link to autism. So we decided ok we best get our son vaccinated. Within 2 days our very content, happy little boy changed. He started screaming, bashing his head against the wall, hitting himself, biting me, kicking me and the list goes on.

According to theories of motivated reasoning, we should not be surprised to see a person previously apprehensive about vaccines attributing a child’s behavior to a vaccine reaction. Indeed, Andrews et al. (2002) found that predisposed parents were more likely to misremember the proximity of the MMR vaccine and the onset of autism symptoms. This provides further insight into the retrospective cost-benefit reevaluation discussed earlier. It suggests that, at least as these parents remember it now, they correctly assessed vaccines as being risky, but proceeded with vaccination anyway only to regret it. For them, the retrospective cost-benefit analysis is not so much a reevaluation as a vindication:

[5.25] I had said I didn't want my daughter to get the amazingly useless, devastatingly dangerous hepatitis-B vaccine at the hospital when she was born, but they gave it to her without asking permission, and she reacted with four days and nights of endless screaming, vaccine-induced encephalitis, and was later diagnosed with autism.

Regardless of whether this parent's interpretation of events is correct or not, there is a clear suggestion in the recounting of the event that preexisting beliefs influence subsequent interpretation. Specifically, the belief that the vaccine is "amazingly useless, devastatingly dangerous" may be the seed of the subsequent belief that the reaction was "vaccine-induced" and the connection with an even "later" diagnosis of autism. Of course, we have not observed this person's belief before and after the vaccine, and so cannot measure the precise influence of prior beliefs upon subsequent ones. We can, however, observe in the way the event is recounted how important this believer considers the prior belief to have been. Again, while this quotation certainly does not prove the influence of motivated reasoning, it is at least consistent with it.

Perhaps even more compelling evidence of the influence of bias upon belief is the conversion of what one side of the debate considers a refutation into what the other side considers proof. For example, as discussed in Chapter 4, pro-vaccine beliefs view data about the genetic origins of autism as refuting any connection between vaccines and autism. Anti-vaccine beliefs, however, view this data as consistent with the vaccine-autism connection:

[4.19] Whether some carry a genetic trait/gene/trigger that predisposes them to Autism with the MMR vaccine being what flips that switch needs to be researched further.
CAUSE or TRIGGER?

In this way, one side's genetic evidence becomes the other side's evidence of harm, as in the following quotation that acknowledges the presence of autism at birth, but still attributes it to vaccine injury:

[5.26] I do still believe that my son acquired autism at birth, or very shortly after. But I am convinced it was the vaccines that did it. HepB vaccine is given at birth, after all. How can anyone honestly say vaccines have no role given that?

The contrast may be even clearer in the following pair of quotations. The first is from a hospital's webpage about vaccine safety, and is used as evidence that autism is caused by genetics and not vaccines:

[5.27] Researchers found that when one identical twin had autism, the chance that the other twin had autism was about 90 percent; for fraternal twins, the chance was less than 10 percent.

In a user comment elsewhere, essentially the same evidence is used to support the opposite conclusion, that vaccines are the cause of autism:

[5.28] How do you then explain that twins who were perfectly fine before having the MMR and shortly after the vaccination BOTH diagnosed with Autism?

The contradiction between these conclusions supports the suggestion that evidence evaluation is a subjective and individualized process subject to the influence of preexisting biases.

Another event commonly seen as a pro-vaccine refutation of the vaccine-autism connection, the retraction and de-licensing of Andrew Wakefield (recounted in Chapter 2), is subject to a similar reframing:

[5.29] There seems to have been an attempt recently on the part of some Max-Vax advocates to imply in the press that the retraction of this one publication has answered all the questions on vaccines and autism.

[5.30] Andrew Wakefield has found himself the victim of a world-wide smear campaign by drug corporations, governments and media companies. And while Dr. Wakefield has been persecuted and prosecuted to the extent of being unable to legally practice medicine because of his discovery, he has instead become a best-selling author.

Rather than a refutation of the vaccine-autism connection, anti-vaccine beliefs view Wakefield's fate as proof that the compromised integrity of the medical establishment is against them. Again, the collected data is consistent with the substantial literature suggesting that the protection of preexisting beliefs motivates the formation of subsequent ones.

The tone adopted in these quotations also supports the related theory that emotion is a principal motivator of reasoning. As we have seen, quotation 5.25 adopts expressly emotional language such as “amazingly useless, devastatingly dangerous” as well as vivid details that enhance the emotionality of the account, such as “endless screaming.” The vivid specificity of quotation 5.24 is similarly emotional in first describing “our very content, happy little boy” and then the details that he “started screaming, bashing his head against the wall, hitting himself, biting me, kicking me and the list goes on.” The specific detail of this account, and the contrast between the boy before and after, heightens the emotion expressed in a way that would not be as effective were those details absent:

[5.24, edited] We put off letting our son having the MMR until he was 18 months old... and then it was reported that... there was no link to autism. So we decided ok we best get our son vaccinated. Within 2 days our ... boy changed.

The presence of such emotional language suggests the emotional influence of the events on the person describing them, including, according to psychology theories of motivated reasoning, the influence of that emotion upon reasoning.

Haidt (2001), while writing about moral decision making, nonetheless offers insights into how humans reason about other matters. In particular, he emphasizes the essential role of intuition in rational processes, and that “moral reasoning is generally a post hoc construction intended to justify automatic moral intuitions” (p. 823) because “we use conscious reflection to mull over a problem until one side feels right. Then we stop” (p. 829). According to Mooney (2011), brain imaging research has documented the human tendency to register an emotional response to an idea so quickly that the thinker is unaware of it. We then engage in reasoning in a subconscious attempt to rationalize the emotional response we have already formed. To modify a metaphor of Haidt’s, while we may believe that in our reasoning we act like detectives—

following the evidence toward the best conclusion—instead we often act like lawyers—advocating for a position and aligning the evidence to support it. In practice, this means that “once people find supporting evidence, even a single piece of bad evidence, they often stop the search” (Haidt, p. 821). It is easy to see the relevance of that finding for Internet searches, where that single piece of bad evidence may be easier to find than ever, and the easily-found refutation may never be sought. Haidt describes the result of this in a way that could well have been a description of arguments on the Internet:

Both sides believe that their positions are based on reasoning about the facts and issues involved... Both sides present what they take to be excellent arguments in support of their positions. Both sides expect the other side to be responsive to such reasons

When the other side fails to be affected by such good reasons, each side concludes that the other side must be closed minded or insincere. (p. 823).

As no Internet user will be surprised to hear, the dynamics that Haidt describes appear repeatedly in the data collected from comments sections.

Again, Haidt is specifically describing moral reasoning, which may have limited applicability to vaccine safety beliefs, but in doing so he draws upon research about many kinds of reasoning, and his conclusions are consistent with psychology research regarding decision making and risk analysis that is more overtly applicable to vaccines. Of particular relevance is the work of Slovic et al. (2004) which explores the relationship between reason and emotion with regard to evaluations of risk specifically. Slovic et al. differentiate between an “analytic system” and an “experiential system” which correlate more or less with reason and emotion, as well as with the perhaps more famous “System 1” and “System 2” of Kahneman (2011). Rather than seeing these systems in contradiction to each other, however, Slovic et al. emphasize the

interrelationship between the systems and the ways in which they complement each other. The experiential system relies on *affect*, which Slovic et al. define as a fast, automatic intuition about whether something is good or bad. Rather than being inferior to, or in opposition to, reasoned decisions, experiential evaluations are an essential part of risk evaluation as a whole. This is because the efficiency of the experiential system guides us in situations where the analytic system would be too slow, such as in the avoidance of immediate danger. This intuitive system also builds upon our past experience to prevent our having to start every evaluation of risk at zero. Affect is a kind of shortcut that assists analysis, rather than contradicting it. Importantly, as we shall explore further in a moment, affect is ubiquitous on the Internet, and likely influences what searchers seek and what they avoid (Yang & Kahlor, 2013).

The relationship of affect to risk evaluation means that when people consider risks, such as the risks of receiving or declining a vaccination, they base their decisions partly on the good-versus-bad intuition of affect.

If their feelings toward an activity are favorable, they are moved toward judging the risks as low and the benefits as high; if their feelings toward it are unfavorable, they tend to judge the opposite—high risk and low benefit. Under this model, affect comes prior to, and directs, judgments of risk and benefit (Slovic et al., 2004, p. 315).

This suggests that judgments of vaccine safety arise from intuitive responses as much as purely reasoned ones. This may provide a mechanism for the formation of Internet echo chambers to the extent that affective intuitions might guide user's choice of information sources more than rational evaluation does (Haidt, 2001; Yang & Kahlor, 2013).

Many of the characteristics that Slovic et al. (2004) attribute to the experiential system are overtly applicable to vaccine safety beliefs. Slovic et al. characterize the experiential system

as (among other things) pleasure-pain oriented, influenced by past experiences, established through narratives and “self-evidently valid: ‘experiencing is believing’” (p. 313). All of these characteristics are directly observable in the collected data, which is rife with accounts of past experience, personal narratives, and suggestions of self-evidence, just like those we have seen in quotation 5.24.

Personal Experience

Emotional, personal experiences are exceedingly common both in the collected data and in other research about vaccine safety beliefs on the Internet (Betsch, 2011; Betsch et al., 2012; Davies et al., 2002; Kata, 2010, 2012; Mills et al., 2005; Nicholson & Leask, 2012). While many such studies do not quantify personal anecdotes about vaccine safety, Kata (2010) found them on 88% of websites in her study. In Betsch’s (2011) sample of eight anti-vaccination websites, seven contained emotive appeals, and anti-vaccination websites were much more likely than controls to contain personal narratives, most of which were vaccine-negative (Betsch et al., 2012). Many, many parents in the present study defend their beliefs with anecdotes about their personal experience, suggesting that that experience was among the evidence most persuasive to them.

[5.31] IF ALL THIS IS SO TRUE CAN YOU TELL ME WHY MY SON IS DEAD
AND THEY FOUND THIMEROSAL IN HIS SYSTEM AFTER DEATH.. ONE DAY
AFTER HE WAS GIV[EN] HIS 2 MONTH SHOTS...

It is not difficult to understand how an experience like the one relayed in this comment could influence parents’ beliefs about vaccine safety. In asking research questions such as those of this study—essentially, why do people believe this?—the persuasive power of personal experience looms large, both in quantity and in power. If the evidence people use to justify their beliefs is

the evidence they themselves find most convincing, then emotional, personal experiences appear to be the most convincing evidence of all:

[5.32] my cousin was a fine and healthy baby till he got a Vaccine and then he got Autism. and that is proof enough for me.

[5.33] within 2 hours[of the vaccines] he had a fever of 104 F. ... After one week, the fever finally passed but he no longer functioned the same. He lost all his language, zoned out, spun around, stopped eating a variety of foods (only wanted French fries) and his bowels were completely messed up. That was many years ago... Dec. 9 1998. The life of our entire family changed that day. He hasn't had a vaccine since.

Pro-vaccine explanations for autism such as changed definition, increased diagnosis and the timing of appearance of symptoms must seem very unconvincing compared to an experience of watching one's loved one change.

At the same time, we might wonder whether there is any reason why such personal testimonials need to be vaccine-negative. Not all of them are. Examples of pro-vaccine personal stories do appear in the collected data, perhaps as an intentional counterpoint to anti-vaccine anecdotes, or perhaps as evidence of the strength of personal experience and strong feeling as motivators of diverse beliefs on opposing sides of the controversy:

[5.34] Have any of you actually HAD the diseases this vaccine seeks to prevent? ... I've had the measles ... I have never in my life been so sick. I had to lie in a dark room for two weeks so that I didn't go blind.

These examples would seem to be just as compelling as the anti-vaccination examples, and just as emotional. At the same time, as we have noted, Betsch et al. (2012) found that more of such content was vaccine-negative than vaccine-positive.

In Chapter 4, we enumerated several vaccine beliefs that we can now understand as having been based on personal experience. This includes rejection of the attribution of autism to a change in diagnostic criteria:

[4.14] With all due respect, I was born in the 1950's and I can say emphatically that there WERE NOT that many "mentally deficient" people of ANY kind. Not 1 in 50, not 1 in 100, not 1 in 200. SOMETHING accounts for the radical increase in this kind of disorder, and I can assure you there has been a radical increase. You are reciting one of the favorite mantras of today's propaganda that vaccines and autism couldn't possibly be linked.

Personal experience also often motivates the belief that vaccine-preventable diseases are not serious, diminishing the benefit side of the risk-benefit calculation:

[4.39] I was born in 1944. It was considered a normal part of childhood to contract measles, mumps, and chicken pox. They were not considered dangerous diseases. I never knew or heard personally of anyone who died of these diseases.

[4.40] ha ha ha! measles, mumps had them both. it was great. I got 3 weeks off school both times and got to go bowling with mom instead of school. Don't remember how sick I was. just being treated special and going bowling and no school! Bring it on! It was way better than getting Autism that's for sure!

Indeed, the observation that vaccination is a victim of its own success draws upon the fact that people no longer have much personal experience with vaccine preventable diseases. In the following quote from an interview, the interviewee's anti-vaccination beliefs are reinforced by the lack of personal experience of outbreaks, but pro-vaccination beliefs emerge with regard to threats she has experienced:

[5.35] That's never happened around here. I mean, you know, not a single outbreak... I would be surprised if there ever was... The biggest problem we have around here is lice. Get an immunization for that, I'm all over it! [Laughter.] Totally serious. That's the last thing I want, is lice.

Similarly, personal experience is often used to justify the opposite belief that the diseases are in fact dangerous, enhancing the benefit side of the calculation:

[4.44] I grew up in the fiftys too. I also contracted all of the childhood diseases, measles, mumps, chickenpox etc. Something else happened to me in the fiftys. My father contracted Polio during the epidemic in the early 1950's and he DIED from it. He was a

healthy, strapping, six foot tall 26 year old. He survived in a iron lung for 1 year before dying.

In addition, as we have noted, retrospective cost-benefit evaluations are motivated by personal experience:

[5.3] I feel tremendous guilt in knowing I allowed my daughter to be shot up with poison and I even helped in keeping her still to do so. How I wish I could go back in time and choose differently.

Furthermore, of course, the influence of guilt in a risk-benefit calculation is explicitly an emotional influence:

[5.36] We allowed my son to get this once after the pediatrician sort of bullied me into it... he was never the same afterwards. It broke our hearts -- my husband and I both cried for days over it and still discuss the event because we are still dealing with the behavioral and physical aftermath of what we did to him... :(Our daughter has NEVER had a vaccine due to this and never will if we can protect her from them.

Even those risk-benefit analyses which compare the risk to one's own child to that of society as a whole derive from a prioritization of individual experience, even if only anticipated, over the collective experience of society, as emphasized by this excerpt from quotation 5.9:

[5.9] I wonder, would it be worth the risk to you if it were YOUR child that was unfortunate enough to have the fatal reaction?

Also, the appeal to get vaccinated for the greater good is often framed around the emotional power of fear:

[5.37] If you don't vaccinate your children, you are doing a criminal act against them, if they ever catch one of these disease, it will horrific.

Looking again at these beliefs we have previously examined illuminates more and more the justification of belief. Vaccine safety is fundamentally a risk-benefit calculation, based on reasoning through the risks and benefits of a particular vaccine for a particular person, a process which is heavily influenced by emotional, personal experiences either anticipated or regretted.

This is one way in which the Internet may indeed make a difference in how people believe. Because Web 2.0's participatory tools enable user-generated content, the Internet increases access to and prominence of personal testimonials, emotional appeals, and anecdotal evidence (Betsch, 2011; Betsch et al., 2012; van Zoonen, 2012; Witteman & Zikmund-Fisher, 2012). Web 2.0 is built on sharing, and sharing amounts to self-disclosure, both produced and consumed.

Us Versus Them

Nicholson and Leask (2012) note that these kinds of appeals challenge ideas of evidence that dominate medical discourse in favor of more personal kinds of evidence, and furthermore that the Internet's "giving voice to wider publics" (p. 3807) augments that more populist evidence. Moore and Stilgoe (2009) note this trend in the MMR vaccine controversy and elsewhere, where "a significant feature of such testimonies is a narrative of unjustified rejection by expertise" (p. 663), as is certainly observable in the collected data:

[5.38] Strange how doctors' treatment of our children is driven by parental input of data — yet that empirical evidence gets reflexively downgraded to anecdotal if one reports vaccine adverse reactions.

This is supported by Kata's (2010) findings that half of websites in her sample portrayed an "us versus them" conflict between parents and the medical establishment that were often seen as dismissive of personal concerns and blindly favoring aggregate data over individual experience (see also Moore & Stilgoe, 2009; Munro, 2010; Witteman & Zikmund-Fisher, 2012).

[5.39] The numerous peer-reviewed studies... provide ample scientific confirmation of vaccine risks, but fail to capture the horrific damage and painful experiences that real families undergo everyday. Calling thousands of similar personal stories "anecdotes" is a dismissive tactic used to discount their significance. Personal stories are another form of evidence.

Of course, the Internet's magnification of individual contribution and redefinition of expertise (Keen, 2006) both play directly into this conflict between established knowledge hierarchies and personal knowledge networks (Quandt, 2012).

That most such content is anti-vaccine (Betsch et al., 2012) is presumably because the anti-establishment voice of vaccine-negative beliefs, considered to be on the fringe of mainstream discourse, finds no better venue than the Internet (Jenkins & Thorburn, 2003; Stempel et al., 2007). Witteman and Zikmund-Fisher (2012) observe that while there is certainly pro-vaccine content online, even in alternative, user-generated content such as blogs, there is no real online community of people who have benefited from vaccination. As we have discussed, vaccination is preventative and its benefits are a non-occurrence rather than an occurrence. Therefore people have little emotional experience of vaccine benefits (Betsch et al., 2012) and have no need to seek a community online. It is the people who think they have suffered vaccine injuries that find themselves scorned by the official, mainstream community and have few venues as easily accessible as the Internet. This is consistent with long-time media studies research suggesting that alienated groups use alternative media because the mainstream media will not take them seriously (Jenkins & Thorburn).

Taken together, these factors—the prevalence of anecdotal accounts of personal experience, the opposition to traditional sources of expertise and the magnification of both of these factors on the Internet—highlight that in this debate, firsthand experience is exalted as superior to other forms of evidence:

[5.40] Anyone can spout numbers and statistics, but when a mother tells me that she noticed a direct change in her child which she believes occurred due to the vaccination that is proof enough for me. Parental instincts are to protect your child, and most parents can naturally sense when something is not right. People trying to diagnose any one illness, disease, syndrome, etc would do well to pay more attention to the personal

accounts of those affected rather than the findings of some study. I myself have seen FIRST HAND how vaccinations can affect certain individuals.

Reason-based conclusions deduced from population-level scientific data have little chance of being as convincing as experiences like these (Moore and Stilgoe, 2009).

There is an interesting contrast here with the idea of *social epistemology* (Fallis, 2006, 2008; Wilson, 1983) according to which very little human knowledge is acquired firsthand through primary experience. Instead, most knowledge is acquired secondhand through other sources upon whose representations we rely. In simple terms, most things that we believe, we believe because we take someone else's word for it. This idea seems particularly applicable to the Internet, which is essentially a collection of secondary sources.

Authority

A key idea at the center of social epistemology, as defined by Wilson (1983) and subsequently applied to the World Wide Web by Rieh (Rieh, 2002; Rieh & Belkin, 1998) is the idea of *cognitive authority*. While there are other kinds of authority, such as the authority to make laws or enforce them, cognitive authority is the particular kind of authority that underlies knowledge and belief. Put simply, cognitive authority is the authority to claim knowledge. As one person receives information from another, he or she evaluates the cognitive authority of the claimant and decides whether or not to believe the particular claim. For example, one might ascribe high cognitive authority to one's doctor and therefore trust the information she provides and incorporate it into one's own knowledge. Alternatively, one might ascribe low cognitive authority to a particular politician and decide not to trust the information provided. (As discussed in Chapter 1, such concepts as trust and credibility are related to, even if distinguishable from, cognitive authority.) In the collected data, appeals to authority—and explanations of how people evaluate authority—are exceedingly common.

The ideas of social epistemology and cognitive authority may be particularly important when considering misinformation on the Internet (Fallis 2008; Rieh, 2002; Rieh & Belkin, 1998). The Internet is constructed (mostly) by humans and thus the evidence there is socially constructed, secondhand evidence. The Internet itself contains little if any primary, direct evidence of vaccine safety. To the extent that the Internet, then, is a collection of secondary sources, social epistemology may be essential to understanding it as a source of knowledge. In turn, cognitive authority, as a key aspect of social epistemology, would also be key to understanding knowledge acquisition on the Internet, and understanding how cognitive authority is evaluated would be key to understanding how evidence is evaluated, beliefs are formed, and knowledge is acquired.

Cognitive Authority of the Self

At the most basic level, people posting comments on the Internet seek to establish cognitive authority through the citation of facts. In essence, this amounts to claiming "I have cognitive authority because I have knowledge", as in the following comment:

[4.45] FACT, diseases have ALWAYS ebbed and flowed before vaccines and continue to do so.

Note that the citation of facts is not unique to the anti-vaccination side of the debate, as pro-vaccination facts are cited in a similar fashion:

[5.41] Autism generally starts to show at around the age they now give the MMR vaccine.

At this level of authority, only the factual claim is made. The claimer apparently expects the claim to speak for itself, and does not provide any external evidence that supports or vouches for his or her ability to know.

At what we might consider a higher level of authority, people attempt to support their claim to authority with some other means such as a citation of sources or establishment of credentials. When attempting to support one's own cognitive authority, a very common means is citing one's own credentials:

[5.42] Being a nurse I find this article very disturbing. First off – the CDC would NOT administer vaccines that are harmful

Again, this strategy is common to opposing sides of the debate:

[5.43] I am a registered Nurse and a mom. I too believe that there are far more illness caused by todays shot requirements then is prevented.

Claims to cognitive authority based on citation of one's own credentials are based on an underlying assumption that amounts to "I know because of my expertise and training." This may appear to be, *contra* social epistemology, a claim to firsthand knowledge. Of course, expertise such as nursing credentials is acquired through education, a thoroughly secondhand means of acquiring knowledge. But these claims regarding one's own credentials are not framed in those terms. The claim is not to having a nurse's education, but rather to being a nurse. Even citations to education, akin to "I have a PhD" or "I have a degree in biology" emphasize the first person knowledge status rather than the secondhand means of learning. In fact, common cultural practice is usually to emphasize the secondhand means of acquiring knowledge only when implying that the knowledge is incomplete, as in "I went to nursing school" or "I took Biology classes" which carry the implicit suggestion that one nonetheless did not become a nurse or biologist. Hence the strongest claims to cognitive authority based on one's own credentials equate one's knowledge status with one's identity rather than with one's learning practice. This dresses the secondhand knowledge of education in the terminology of the firsthand knowledge of experience.

Often, however the claims to the superiority of firsthand knowledge are more explicit. It is interesting to note in quotation 5.43 above the commenter's reliance not only on her medical expertise as a nurse, but on her additional expertise as a mom, by which she apparently intends to strengthen her claim to cognitive authority.

As we have already discussed, personal experience is very often cited as a reason for beliefs about vaccine safety. In epistemological terms, this means citing personal experience as a supporting credential for one's own claim to cognitive authority.

[5.44] My credentials is what happen to my child

[5.45] I have to inform you that NO ONE knows a child/baby better than its own mother! What is going on here is NOT a mere random correlation of events, nor coincidences" God gives us wisdom as mothers,.....something that perhaps you need to know and consider before making such foolish claims. These parents KNOW what they are saying, and they KNOW what the truth is!!!

These kinds of appeals, of course, are explicitly claims that firsthand experience is superior to secondary experience, is in fact more reliable, and hence that social epistemology is inadequate.

Some people take this so far as to claim that without personal experience, one has no cognitive authority on the issue at all:

[5.46] If you're just talking to talk and don't have any children with Austism, your output is worth zero.

This position is emblematic of something Nicholson and Leask (2012) have noted, that "parents of autistic children were seen to understand the issue because they had lived it. By that measure, doctors, scientists and governments were seen as less eligible to provide evidence because they did not have this tangible experience" (p. 3810.) Often, this rejection goes so far as to characterize scientific methods as inappropriate or incapable of addressing the issue (Munro,

2010). For such parents, the only credentials that establish cognitive authority about vaccine safety are personal experiences with autism.

In general, the establishing of one's own expertise may be more important on the Internet than in other information sources. Since authority on many parts of the Internet is not established through traditional markers such as those found in encyclopedias, newspapers, etc, such claims do not automatically inherit the credibility of their source (Metzger, 2007; Metzger et al., 2010; Metzger et al., 2003; Rieh, 2002; Rieh & Belkin, 1998). This is, of course, particularly true of comments sections. Each person making a factual claim must establish his or her authority independently, increasing the need to cite one's own credentials in such environments. This requirement can also be empowering, because the Internet provides an ability to establish authority that one may not previously have had. Anti-vaccination beliefs seem to take particular strength from this ability. Perhaps in previous information environments, one could have believed one had the authority to disagree with the consensus of a number of organizations, but prior to the Internet, one likely had less ability to exercise that authority.

As we have already noted, the importance of personal authority may be enhanced by the personal nature of the Internet. Betsch et al. (2012), van Zoonen (2012) and Witteman and Zikmund-Fisher (2012) note how the user participation tools of Web 2.0 increase the amount of personal authority available. In particular, as Betsch (2011) notes, the interactive tools of social media make personal, anecdotal testimony both easier to post and easier to find. The prevalence of this kind of data may enhance its influence, especially to those inclined to find the testimony of parents more trustworthy than official, traditional sources which, as Serpell and Green (2006) put it, "may be seen as having some self-interested investment in conspiring against the public, whereas the motivation of the parent of a child with autism is less obviously open to question."

(p. 4042-4043). This would seem to apply more broadly than just social media to include other participatory aspects of the Internet as well, comments sections certainly among them.

It is important to note, however, the way in which many arguments about the individual empowerment of Web 2.0 technologies depend on anecdotes on the Internet being persuasive to others. As Betsch et al. (2012) put it

Narratives of purported vaccination injuries include all of the key elements of memorable messages: They are easy to understand, concrete, credible in the way in which a first person story of victimization is always credible (“I was there!”) and highly emotional.

These qualities make this type of information compelling (p. 3730).

The assertion here is that the prevalence of emotional anecdotes on the Internet contributes to misinformation about vaccines because emotional anecdotes are so persuasive.

In the data collected for this study, however, there is much more evidence of people being persuaded by what happened to them than by what they hear happened to others. At least two other studies noted a lack of peer pressure as an influence on vaccination (Evans et al., 2001; Poltorak et al., 2005), observing instead a preference for “people making their own choice” (Poltorak et al., p. 908). This is important in light of the common aspersion that the anti-vaccine movement prefers the authority of celebrities like Jenny McCarthy to the authority of doctors (as in quote 4.80 in Chapter 4.) Few if any people cite Jenny McCarthy as a source of their belief. Rather, some champion her as a spokesperson for their own experiences. At the same time, the influence of opinion leaders on the diffusion of information is well-researched (Rogers, 2002; Hall, 2004) and peers can be particularly influential on belief (Granovetter, 1973; 1985). Indeed, some of the present study’s interview subjects spoke of living in an area where vaccine safety doubts seemed more common than elsewhere. This is consistent with epidemiological data that

low vaccination rates tend to cluster geographically (Lieu, Ray, Klein, Chung & Kulldorff, 2015; Omer et al., 2008). Of particular relevance to the present study, Kareklas et al. (2015) found that user comments could influence people's belief in a public service announcement about vaccines more than the announcement itself. Importantly, however, the comments used were all either supportive or critical of vaccination, not mixed. This is a much different environment than the comments data collected for the present study, which is often back-and-forth disagreement. However it may appropriately reflect the typical research habits of a pro- or anti-vaccination person who may choose an Internet source where the majority or all of the comments agree. Overall, the emphasis of the present data is not on the extent to which vaccine safety beliefs might be influenced by secondhand accounts of the personal experiences of others. Rather, it provides numerous examples of firsthand experiences justifying one's own belief.

While Web 2.0 may mean that the modern media environment is saturated with accounts of personal experiences, the experiences probably persuade those who had them much more than those who hear about them. Importantly, these compelling emotional experiences did not take place on the Internet. Therefore while the Internet may increase the persuasiveness of secondary experience, it seems unlikely that it affects the firsthand experience that so compels vaccine safety beliefs.

To the extent that secondary testimony of others does seem to influence such beliefs, it is more commonly seen as cumulative support for personal experiences:

[4.15] How do you explain the countless examples of children who literally changed overnight immediately after receiving their inoculation? Coincidence?

On the Internet, ease of access to similar experiences may influence how one interprets one's own experiences, such as when a parent of an autistic child finds an explanation in the vaccine injury allegations of others. Similarly, the Internet may enhance the appearance of consensus, as

when a parent suspecting his or her child has been vaccine damaged finds corroborating anecdotes on the Internet. While this does suggest ways in which the prevalence of personal, emotional anecdotes on the Internet might influence belief, it may work differently than Betsch et al. (2012) describe. Rather than creating misinformed belief, the Internet may simply support beliefs already formed offline, exactly as echo chamber hypotheses feared.

Cognitive Authority of Others

This is not to suggest, however, the failure of social epistemology as an explanation of Internet knowledge acquisition. Indeed, there is much evidence in the collected data of beliefs formed or supported through social means, including means that are enhanced by or even unique to the technology of the Internet.

Some commenters defend their views by identifying the source of their knowledge. At the most basic level, this means a general citation of the source of a claim:

[5.47] O'Shea has a... book called "Vaccination is not immunization" that is a must read for anyone interested in the facts. In this book he has lots of data that is backed by references and a lot of doctor support for his work.

Here, the commenter refers to a source that he or she finds credible, including basic reference information, but does not provide any credentials to establish the source's cognitive authority.

One is left to find, investigate and evaluate the source oneself. This particular quotation does take the extra step of attempting to enhance the source's authority by referring to "data," "references" and "doctor support," but again this is non-specific and leaves any potential reader of the comment to do his or her own investigation.

Some commenters assemble more specific support for the authority of their sources. As with individuals seeking to establish their own authority, some cite the credentials of others to establish the cognitive authority of sources.

[5.48] The supreme court ruled, that vaccines are unavoidably unsafe. The highest court in the land.

Though it probably was unnecessary to do so, this commenter reinforces the source of his own knowledge by emphasizing that it is the “highest court in the land.”

Claims regarding the credentials of others are also used for the opposite purpose, to question or undermine the cognitive authority cited by another. Sometimes, this technique is used in an attempt to discredit the authority someone has claimed for themselves:

[5.49] Who cares that you’re an RN? There are RN’s that disagree with you. There are M.D.’S that agree with you and there are M.D.’s that don’t agree with you.

Other times it attempts to discredit an authority that someone else has cited:

[5.50] [He] is not a “doctor.” He has a PhD in computer science from what was then a unaccredited degree mill. And his “research” has not been repeated nor validated.

A particularly common tool for attacking the cognitive authority of another is the accusation of bias, as we saw in Chapter 4:

[4.70] It sounds to me like you... are either a kickback taking doctor, a pharmaceutical representative, or one of the “herds” that has been brainwashed into believing all doctors are gods. Get a grip or get a brain.

[4.56] LEADING CAUSE OF DEATH in this country is doctors and pharmaceuticals. What a huge cover up. I don’t trust the medical industry they are all about the \$\$\$\$\$.

Accusations like these function not only to undermine the authority someone else has claimed; they also attempt to bolster the authority of the critic. In quotation 5.50, the commenter resorts to the first technique we discussed, the citation of unsubstantiated facts, in order to position his or her own authority as superior to that of the person being criticized (both the doctor and the person who cited the doctor.) In quotations 4.70 and 4.56 the integrity of the stated position is alleged to be compromised by financial incentives that may undermine objectivity. At the same

time, these comments imply the superior insight of the commenters who are not misled by bias. Yet again on the Internet we observe the exaltation of personal authority above all other kinds.

The following quotation is even more illustrative of this phenomenon:

[5.51] So have you researched and tested the vaccines yourself? have you conducted thorough studies?

Here again is an articulated challenge to the very idea of social epistemology. Implicit in this comment is the assertion that no secondhand knowledge can suffice, but that only people who have conducted firsthand research could possibly have appropriate cognitive authority. While the quote is unique and its demands atypical, it demonstrates by exaggeration the contradictory logic of cognitive authority about vaccine safety on the Internet. On the one hand, the Internet is seen as a platform for the discovery of previously unavailable truths, and for the airing of anti-establishment positions. Thus the Internet is seen as the place where repressed testimony is at last being heard. On the other hand, the Internet is a collection of secondary sources, and indeed does not lend itself to firsthand research of vaccine safety, and therefore all of its claims are demonstrably unreliable, especially to those who disagree.

To unpack this contradiction further, we might consider the ways in which cognitive authority seems to function differently on the Internet than elsewhere. While the various aspects of cognitive authority discussed thus far are present on the Internet, none of them are particularly unique to the Internet. People do make and have made unsubstantiated factual claims in every information environment. They sometimes support those assertions by citing their credentials, or with non-specific references to the source of their knowledge. They even debate each others' claim to know, including accusations of bias. All of these negotiations over cognitive authority could take place in an argument in a bar (before the age of Internet-connected mobile devices); they are no different just because that argument takes place on the Internet. To some degree,

however, the technology of the Internet alters the negotiation of cognitive authority in ways that are not available in other information environments.

The most obvious of these is the use of linking. The Internet provides the unique ability not only to refer to a source, but to provide it directly to someone else. While in the aforementioned bar fight we might be lucky enough to be carrying a particular source in our bag, on the Internet every source is in our virtual bag, and our ability to provide it to others is nearly effortless and limitless.

[5.18] here's a great study of half a million danish, a good section were not vaccinated- generally the same rates [of autism]. [provides link]

[5.52] Actually, there are plenty of studies that link autism to vaccines. This is a link to a list of approximately 150 scientists and physicians who have serious concerns about vaccine safety. [provides link]

The Internet, therefore, enables us to establish cognitive authority with a mere cut and paste, and to verify cognitive authority with a mere click. This is so easy, in fact, that it seems to raise the expectation of evidence required on the web:

[5.53] Where is an article that links specific unvaccinated individuals to having a disease and infecting other people.

[5.54] Please post the text of the court decision “admitting” your assertions. Can’t find it? Neither can I. I *can* find lots of sloppy articles on this and related sites, claiming that a monetary awards damage “proves” the vaccine link [to autism.]

Comments such as these suggest that the expectations for evidence are higher on the Internet because of the ease of retrieval. It is perhaps not enough merely to provide the secondhand experience of naming sources; one is expected to provide the ability for a firsthand evaluation of the source. It is interesting to speculate, however, on whether this actually raises the standard of evidence or only appears to. It seems unlikely that most people click the links at all, much less read the entire article. (Indeed, there is evidence in the collected data of commenters who have

not even thoroughly read the article on which they are commenting.) Therefore, this apparent demand for citation on the Internet may functionally be a demand for the appearance of evidence that few if any people will actually verify.

There are other suggestions in the collected data about how the Internet may raise the expectation of evidence. Much like the ease of linking may raise the demand for citation, so the ease of search and retrieval seems to raise the demand to inform oneself:

[5.12] polio was all but gone until they brought a vaccine out that started it up again, you do some research and come back to me

Implicit in comments like this one, which are quite common in the collected data, is the suggestion that if “you” disagree, it is because “you” have not done proper research. This is more than just a claim of the ignorance of others; it amounts to a positivist claim that truth is available if only one looks. It does not suggest where “you” might do research, or that you might disagree with what you find. It suggests that, at least as far as this commenter believes, it is sufficient merely to do research at all. The claim to cognitive authority is here based on self-evidence. No sources or credentials are believed to be needed, as the truth is so obvious it will reveal itself.

At the same time, these apparently positivist claims have a contradictory postmodernist underpinning. As Kata (2010; 2012) has noted, the implied disregard for traditional cognitive authorities is rooted in a postmodernist redefinition of expertise. Of course, the redefinition of expertise is also a frequently noted consequence of Web 2.0 (Keen, 2006). A call to do research implies a call to look beyond traditional expertise and empower oneself to find and to know, as explicitly stated in the following quotation:

[5.55] Free-thinking mothers who do their own research are not fooled by this pathetic propoganda, and to expect us to robotically accept these flat-out lies mixed with twisted "truths" is nothing short of an insult to our intelligence.

This quotation repeats the claim to self-evidence of quotation 5.12 and adds the important additional layer of doing one's "own" research. This suggests that other sources are not to be trusted, but even more importantly, implies the superiority of the individual user's knowledge acquisition abilities. Again, as van Zoonen (2012) and Witteman and Zikmund-Fisher (2012) have noted, the specific tools of Web 2.0 may lend themselves to such a concept of research, both in the way that Web 2.0 enhances user participation in creating information and in accessing it, but also in the way that the open architecture of the Internet makes "informed decision making" easier. As Witteman and Zikmund-Fisher put it:

Online openness means that data and information are readily accessible and may be questioned, corrected and built upon to create new knowledge... As Web 2.0 progressively allows free and open access to data, more and more decisions... are becoming recast as being within the purview of individuals (p. 3736).

For Internet users displeased with traditional sources of cognitive authority, as is often the case with those concerned about vaccine safety, the Internet's enabling of one's "own research" implies a truth now unobscured because of the Internet, there to be discovered as self-evident once one makes the effort to look. This is the implication of quotation 5.55 in its comparison of the "free-thinking" enabled by the Internet with the "pathetic propoganda [*sic*]" of others claiming cognitive authority on the issue. Such a quotation serves as almost a manifesto in its exaltation of firsthand knowledge, which at last has broken free from the "lies" and "twisted 'truths'" of pro-vaccination authorities. It implies a point at which one ascribes cognitive authority to oneself, as if to say, "my research is superior to what anyone else tells me, and hence my cognitive authority is superior to everyone else's." This is perhaps the most powerful claim to firsthand knowledge of them all.

In summary then, while the Internet would seem to be a collection of secondhand knowledge, it is also rife with exaltation of firsthand knowledge as a superior, and uniquely accessible, means of knowing. In particular, the participatory tools of the Internet seem to influence how cognitive authority is established and appraised. Whether through citation of sources, the establishing of credentials, or the objection to them, cognitive authority functions through a rich and complex set of negotiations among Internet users. To the extent that reasoning about vaccine safety derives from examination of evidence, the Internet enhances that examination through the ease with which users can provide, retrieve and verify that evidence through searching and linking. In the data collected for this study, the ease of informing oneself rises to the level of claims of self-evident truth, alleged to be available to all who conduct proper research. Consistent with concerns about Internet echo chambers, however, such research is often influenced by pre-existing beliefs, particularly those rooted in firsthand personal experience. To the extent that such experiences are persuasive in risk evaluation, it is relevant that the user participation technologies of Web 2.0 appear to make accounts of those experiences more prevalent on the Internet than in other media. Furthermore, the quantity of negative anecdotes apparently increases in areas where the Internet provides a haven for beliefs in opposition to mainstream thought and traditional expertise. Notably, it is those very boundaries between traditional, mainstream belief and alienated, minority belief that often define what counts as misinformation and what does not, under the presumption that consensus belief is accurate and contrary belief misinformed.

A Model of Evidence Evaluation

Although we have divided belief justification into four discrete categories—risk-benefit, reason, personal experience and authority—the formation of belief in practice is rarely so

modular, nor does it take place in steps or in a particular order. Indeed, the distinctions are fuzzy at best, since risk-benefit calculations are a kind of reasoning and personal experience is a kind of authority. While all beliefs about vaccine safety amount to risk-benefit determinations, those determinations rely upon reason, personal experience and authority in complex patterns that vary across beliefs, believers and situations. Therefore we should not think of the four techniques of belief justification as operating independently, but rather in an overlapping Venn-like relationship wherein the core risk-benefit stance is negotiated through reason, personal experience and authority, which in turn influence each other (Figure 5.1).

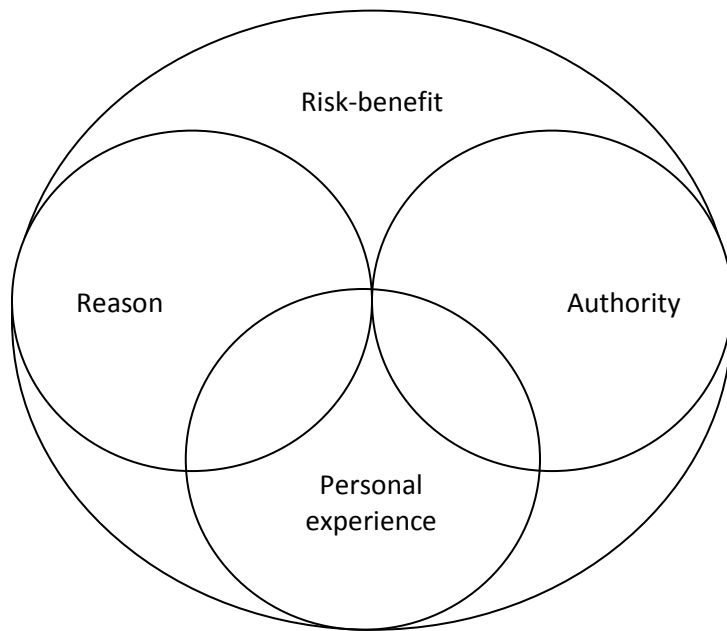


Figure 5.1. Relationship between elements of belief justification.

This diagram illustrates the primary relationships between the means of justification most prominent in the collected data. The central evaluation of risk and benefit is derived from some combination of reason, personal experience and authority. In turn, personal experience influences both reason and authority.

Other conceivable relationships may exist, such as ways in which reason may determine which authority to believe, although that overlap is not prominent in the present data. Every distinction between two things risks oversimplifying those things, as this model may well do. But the model intends to highlight the primary relationships that emerge strongly from the data, even if other relationships are potentially present.

In summary, to the extent that the way people justify their beliefs illustrates how they evaluate evidence, vaccine safety beliefs appear to compare the risks of vaccination to its benefits. Each evaluator primarily determines the risk and benefit of the various elements—including vaccines, diseases and schedules—by reasoning through evidence, comparing it to personal experience, and determining which authority to believe. Personal experiences, especially emotional ones, motivate reasoning to be consistent with previous beliefs. They likewise influence which authorities are considered credible, often to the extent that one's own authority, based upon personal experience, trumps any claims inconsistent with it. The overall picture painted in the data is that these four evaluation tactics, in these primary combinations, sort through contradictory evidence to arrange a limited, recurring set of beliefs into diverse viewpoints.

CHAPTER SIX

CONCLUSIONS

In combination, the beliefs outlined in Chapter 4 and the justification tactics outlined in Chapter 5 begin to untangle why some people believe vaccines are safe and some believe they are unsafe. Again, these generalizations about belief are based upon the assumption that present tense justifications for beliefs reflect the past tense process of belief formation. We must be careful to remember that how someone justifies their belief on the Internet or in an interview is not the same as the actual process of forming it. For example, we are unable to distinguish whether a believer relied upon certain evidence before deciding what to believe, or whether that believer subsequently adopted that evidence as reinforcement. Despite this, from the way that someone expresses and justifies a belief we may infer what they find convincing, and to a significant if imperfect extent we may begin to understand how and why they believe.

In particular, the evaluation strategies explored in Chapter 5 expand and illuminate the buffet metaphor of belief profiles discussed in Chapter 4. As with food items in a buffet, the available beliefs are limited, as the same beliefs recur over and over in the data. Yet just as each patron of a buffet can combine the limited selections into individualized meals, so do people combine vaccine beliefs into individualized combinations. Buffet diners select food to suit their taste, considering such factors as what food they like, what food they are in the mood for, the need to eat a balanced meal and the extent to which one item might go well with another. At least in the case of vaccine safety, belief “taste” seems to consist of the evaluation tactics from Chapter 5 which guide the selection of items. In other words, just as food items are chosen through a combination of pre-existing influences and present circumstances, so too are beliefs, as there appears to be a relationship between certain beliefs and the tactics used to evaluate them.

Associations Between Beliefs and Evaluation Tactics

Comparing the beliefs discussed in Chapter 4 to the evaluation tactics discussed in Chapter 5 suggests associations between certain beliefs and certain tactics. Table 6.1 suggests relationships between the four primary categories of belief outlined in Chapter 4 and the four tactics of evaluation outlined in Chapter 5. Associations are drawn based upon observation of common trends in the collected data. The strength and weakness of the associations reflect the ease of identifying examples of each association in the data. The division into anti-vaccination and pro-vaccination tactics reflects the degree to which each tactic appears to justify anti-vaccination and pro-vaccination beliefs, respectively. The associations reflected in this table have not been rigorously counted nor statistically correlated; they represent qualitative and not quantitative assessment.

Table 6.1: Associations between beliefs and evaluation tactics

<u>BELIEFS</u>	<u>Anti-vaccination</u> <u>tactics</u>		<u>Pro-vaccination</u> <u>tactics</u>	
	Strong	Weak	Strong	Weak
Toxicity	Risk-benefit Personal experience	Reason Authority	Risk-benefit Reason Authority	
Cumulative effects	Risk-benefit Personal experience	Reason Authority	Risk-benefit Reason Authority	
Premise of immunization	Risk-benefit Reason Personal experience	Authority	Risk-benefit Reason Authority	Personal experience
Compromised integrity	Authority	Risk-benefit Reason Personal experience	Authority	Risk-benefit Reason

As we have seen, the primary decision about vaccine safety—whether to get a particular vaccine or not—is a risk-benefit analysis, in that it is overall a consideration of whether the vaccine is too big a risk or provides a big enough benefit. The specific beliefs that comprise that overall decision—the four beliefs listed in Table 6.1—are themselves based upon risk-benefit

calculations to varying degrees. Beliefs about toxicity, for example, represent an analysis of the risk of toxicity as compared to the risk of foregoing the vaccine. Beliefs about the cumulative effects of vaccines are comparisons between the risks of multiple vaccines or combined vaccines as compared to the risk of delayed or selective vaccination. Anti-vaccination beliefs about the premise of vaccination view both the benefit of the vaccine and the risk of the disease to be low. Beliefs about compromised integrity seem to be the least dependent on risk-benefit evaluations, but the related beliefs about civil liberties compare the risk to society against the risk to the individual. While each of these negotiations is probably influenced by reason, personal experience, and authority, it does seem as though some of these elements support certain beliefs more than others.

For example, consider how people might form anti-vaccine beliefs about toxicity. They may use reason to determine that since mercury, aluminum and formaldehyde can be dangerous, vaccines can be dangerous too. They may also reject the assurances of medical authorities, although that rejection likely derives from other beliefs, such as about compromised integrity. Neither reason nor authority, however, seems as strong a motivator as emotional responses such as fear and disgust. The idea of putting certain substances into a human body arouses visceral negative reactions, as reflected in descriptions such as “poison.” While such believers may reject the medical community’s attempts to reassure them, it seems likely that the emotional reaction to toxicity inspires the rejection of authority rather than the rejection inspiring the emotional reaction. What’s more, the use of reason and authority to defend anti-vaccination beliefs about toxicity seems more common as a counter to the reason and authority used to defend pro-vaccination beliefs. Thus the toxicity row of Table 6.1 represents reason and authority as weak anti-vaccination tactics and personal experience as a strong anti-vaccination tactic.

On the other hand, beliefs that toxicity is not a concern would seem to rely less on emotion and more on reason-based appeals to chemistry and trust in medical authorities. Many people holding pro-vaccination beliefs about toxicity seem to reject emotional testimonials about the timing of vaccines and autism symptoms, preferring reason-based understandings of coincidence versus causation. Likewise, many pro-vaccination believers counter the toxicity of ingredients with reasoned analyses of dose sizes and chemical properties. They may also simply believe the FDA and CDC's assurances that vaccines are safe. Meanwhile, there are few if any examples of how personal experience might motivate pro-vaccination beliefs about toxicity, and hence Table 6.1 lists reason and authority as strongly associated tactics and does not list personal experience at all.

A similar balance of tactics appears to underlie beliefs about the cumulative effects of vaccines. People with anti-vaccination beliefs about cumulative effects often fear introducing too many substances into a young child's system (an emotional response that we categorize as personal experience). Some also reason that autism and other negative outcomes are attributable to the rise in the number of vaccines given, and accuse medical authorities of insufficiently understanding cumulative effects. People with pro-vaccination beliefs about cumulative effects tend to downplay emotional responses in favor of the reasoned conclusion that disease protection should be acquired as early as possible. Likewise, they tend to rely on the assurances of medical authorities that the recommended schedule is safe. Thus the strategies used to evaluate cumulative effects are essentially the same as those used to evaluate toxicity.

Beliefs about the premise of immunization, however, seem to arise from a slightly different combination of tactics. People who deny the premise of immunization often speak of personal experiences such as a bad reaction to a vaccine or infections with vaccine preventable

diseases that were benign. People who accept the premise of vaccination similarly rely upon negative personal experiences with vaccine preventable diseases. Since most people do not personally experience a prevented disease, however, they must rely on the representations of others that the vaccine prevents the disease. Hence for pro-vaccine beliefs about the premise of immunization, authority seems a stronger motivator than personal experience, and the rejection of such authority is correspondingly characteristic of anti-vaccination beliefs. Many believers apply reason to reach opposing conclusions. Those with pro-vaccination beliefs often justify them with evidence such as declining rates of infectious disease. Those with anti-vaccination beliefs question those rates, and often refer to concerns believed to arise from the injection of a disease agent into an otherwise healthy body. Thus reason is a strong motivator on opposing sides of the debate between beliefs about the premise of immunization, while authority and personal experience are also employed on opposing sides, but to differing degrees.

Beliefs about compromised integrity seem most strongly rooted in considerations of authority. A belief that a person's integrity has been compromised amounts to a belief that they do not have the authority to know. Secondly, this is a reason-based evaluation, since part of the calculation is the extent to which the compromised integrity influences the evaluation of authority. For example, Paul Offit, who has written extensively in support of vaccines, is often seen to be hopelessly compromised by having patented a rotavirus vaccine (see quotation 6.4, below.) Pro-vaccination arguments, however, consider this patent evidence of his expertise on the topic. There may be some element of personal experience as well, since some people who have had unpleasant healthcare experiences cite them to justify anti-vaccination beliefs about compromised integrity. Overall, however, beliefs about compromised integrity seem to amount to reasoning through evidence about the authority of sources.

Overall across the four categories of belief, the pattern is consistent with buffet-style belief formation. On the one hand, the situation resembles popular conceptions: anti-vaccination belief derives heavily from emotional personal experience, and pro-vaccination belief relies heavily on authority and reason. As depicted in Table 6.1, emotional personal experiences are strongly associated with three anti-vaccination beliefs and weakly associated with only one pro-vaccination one, suggesting that emotion and personal experience are particularly persuasive to anti-vaccination belief. This is not always the case, however, as is particularly evident in the strong emotional reaction some people have toward those they perceive to be endangering society by not vaccinating. And importantly, there are people with anti-vaccination beliefs who do not have personal experiences such as vaccine injury, and thus attributing anti-vaccination beliefs entirely to emotion and personal experience would leave many cases unexplained.

Perhaps more surprising is the strength of reason and authority as motivators of anti-vaccination beliefs. Authority has strong associations with all four categories of pro-vaccination belief, and only one strong and three weak associations with anti-vaccination belief. Nonetheless, authority appears as a motivator for every belief, even if to varying degrees. Importantly, anti-vaccination beliefs about compromised integrity are fundamentally beliefs about authority, and people often justify anti-vaccination beliefs using alternative authorities, suggesting that it is not a matter of whether authority is used but of what is considered appropriate authority. Likewise, opposing sides of the debate justify their beliefs using reason, which associates either strongly or weakly with every category of belief, having four strong associations and four weak ones. The disagreement is as to what constitutes correct and incorrect applications of reason. The ultimate insight appears to be, therefore, that vaccine safety

beliefs are not a matter of the presence or absence of any particular evaluation tactic so much as of the degree to which the tactic is employed.

Importantly, these examples do not outline every possible combination of beliefs or evaluation tactics. It would be an oversimplification to imply that belief x always derives from tactic y or never derives from tactic z . As the buffet metaphor implies, beliefs are complex and virtually any combination of beliefs and tactics is possible. The noted associations are subjective and other associations are conceivable, although they do not appear in the present data to any significant degree. Even the evaluation tactics themselves are not always discrete, as discussed in Chapter 5. At the same time, some combinations of beliefs and tactics are more common than others.

Similar Tactics

A useful insight of this analysis may be the observed use of similar tactics to justify diverse, and often opposing, beliefs. While each person uses the tactics in different ways and to different degrees, the same basic tactics are used. Hence the construction of individualized belief profiles from among a limited buffet of beliefs may derive from the selection from a limited buffet of tactics, in individualized combinations. Indeed, sometimes this similarity of tactics is overtly emphasized in the data:

[6.1] The MMR vaccine is NOT the cause; it has been around a long time, while autism has steadily rose with the increase in processed foods.

[6.2] [in response to 6.1]: So aren't you doing the exact same thing that you are accusing others of? You are blaming junk food. Please show me the studies that show that junk food causes autism.

The commenter in quotation 6.1 justifies the belief using reason, rejecting the correlation between the MMR and autism as spurious while noting a correlation between processed foods and autism. The responding comment also applies reason to implicitly note the conflation of

causation with correlation, then adds an appeal to the authority of scientific studies. While this is a particularly overt example, we have already seen examples of beliefs on opposing sides arising from each of the tactics we have identified.

Consider the use of the risk-benefit comparisons we have repeatedly identified as fundamental. They are applied from all sides of the issue, as we saw in the following quotations:

[5.1] Every child I will ever have will be vaccinated, even if there is a possibility of autism, even if it's strong, because I could never consider the chance of autism as more important than the life of my child.

[4.41] One person out of a thousand died from an outbreak of measles? Those odds are a lot better than putting every kid at risk for autism.

Again, while the tactic of a risk-benefit consideration may be applied differently by different people to reach different conclusions, it is fundamentally the same tactic regardless of who applies it. To see this, consider the same quotations abstracted to their core logical structure:

[5.1a] Every child I will ever have will be [status], even if there is a possibility of [risk 1], even if it's strong, because I could never consider the chance of [risk 1] as more important than the life of my child.

[4.41a] One person out of a thousand died from [risk 1]? Those odds are a lot better than putting every kid at risk for [risk 2].

Note that absent the specifics of what the risk is, these sentences say essentially the same thing.

To see this even more clearly, note the change when the opposite risk is substituted into each position. Making risk 1 “autism” and risk 2 “a vaccine preventable disease” makes both statements pro-vaccination:

[5.1b] Every child I will ever have will be [vaccinated], even if there is a possibility of [autism], even if it's strong, because I could never consider the chance of [autism] as more important than the life of my child.

[4.41b] One person out of a thousand died from [autism]? Those odds are a lot better than putting every kid at risk for [a vaccine preventable disease].

Likewise, reversing the risks, so that risk 1 is “a vaccine preventable disease” and risk 2 is “autism” makes both statements anti-vaccination:

[5.1c] Every child I will ever have will be [unvaccinated], even if there is a possibility of [a vaccine preventable disease], even if it's strong, because I could never consider the chance of [a vaccine preventable disease] as more important than the life of my child.

[4.41c] One person out of a thousand died from [a vaccine preventable disease]? Those odds are a lot better than putting every kid at risk for [autism].

Clearly, the difference in these statements is not how they consider evidence, but what evidence they consider. In other words, both use the same risk-benefit analysis, but base it on different characterizations of risk and of benefit.

We have likewise already observed similar uses of reason to reach opposing conclusions. A common example is when one commenter uses reason to refute a previous reason-based assertion, as in quotations 6.1 and 6.2 above. Another example is when the same techniques of reason arrive at opposing conclusions:

[4.18] If it's vaccines, then why are Boys are 5x more likely than girls [to have autism]?????

[5.17] why is there a compensation fund for vaccine injured children and a website specifically to report adverse reactions if it never happens.

These examples show the use of basic if-then deductions to arrive at opposite conclusions. Of course, this is not to say that different conclusions are deduced from the *same* premises, as that is not what is illustrated here. Rather, these quotations demonstrate the use of the same technique of evidence evaluation, even though the evidence itself is different.

This is also how other tactics are used on opposing sides of the debate. For example, similar uses of personal experience as a tactic are nonetheless based on different personal experiences:

[4.40] ha ha ha! measles, mumps had them both. it was great. I got 3 weeks off school both times and got to go bowling with mom instead of school. Don't remember how sick I was. just being treated special and going bowling and no school! Bring it on! It was way better than getting Autism that's for sure!

[4.44] I grew up in the fiftys too. I also contracted all of the childhood diseases, measles, mumps, chickenpox etc. Something else happened to me in the fiftys. My father contracted Polio during the epidemic in the early 1950's and he DIED from it. He was a healthy, strapping, six foot tall 26 year old. He survived in a iron lung for 1 year before dying.

Likewise, although the use of authority is common to opposing sides of the debate, the authorities considered are very different:

[5.18] here's a great study of half a million danish, a good section were not vaccinated- generally the same rates [of autism].

[5.52] Actually, there are plenty of studies that link autism to vaccines. This is a link to a list of approximately 150 scientists and physicians who have serious concerns about vaccine safety.

This is the reason that the same tactics can result in such different beliefs. While evidence is evaluated in the same few ways, it is not always the same evidence that is evaluated. Hence we do not mean to argue that both conclusions are equally valid simply because they use the same technique. How the techniques are applied and the quality of the evidence they use makes all the difference in determining the quality of the evaluations, but for the present study we are concerned not with *how well* people evaluate evidence about vaccine safety, but merely with *how* they evaluate it at all.

On the other hand, sometimes the same evidence does support opposing conclusions.

Consider these two quotations we have examined before:

[5.42] Being a nurse I find this article very disturbing. First off – the CDC would NOT administer vaccines that are harmful

[5.43] I am a registered Nurse and a mom. I too believe that there are far more illness caused by todays shot requirements then is prevented.

Note that in this case, both the technique used and the evidence are identical. That is, the technique used is an appeal to authority, specifically an attempt to establish one's own cognitive authority through the use of credentials. The credentials, however, are the same, despite the opposing conclusions. Being a nurse justifies both pro-vaccination and anti-vaccination beliefs.

As a salient example of the similarity of tactics on opposing sides, consider this quotation from a website in the data:

[6.3] Unfortunately there are some people who are propagating vaccine misconceptions that are at odds with the science or, in other cases, making statements that are technically correct but are scientifically misleading. It is important to recognize these misconceptions.

This quotation may appear to be pro-vaccination, but in fact it is from the introduction to a long post about how vaccines are unsafe. It may appear pro-vaccine because it deploys evidence evaluation tactics that are more commonly presumed to support pro-vaccination beliefs. The use of the words “science” and “scientifically” reflect an appeal to authority, in particular the authority of science. This is supplemented by an appeal to reason with the suggestion that opposing evidence is “misleading.” The same post contains language elsewhere suggesting an appeal to the authority of science, such as that vaccine safety and side effects “have not been extensively tested in human populations” and that “these studies are fraught with design problems and potential bias.” While both examples use scientific authority as a tactic for evidence evaluation, they do so in different ways. The first example calls upon science as a valid technique by calling for more extensive testing in humans. The second example rejects the validity of existing science by highlighting flawed methodology and potential bias. Thus science is framed both in positive and negative terms, depending on its conclusions (see also Nelson, 2010), and the use of the authority of science is not limited to pro-vaccine beliefs. Indeed, neither is the criticism of peer-reviewed science limited to anti-vaccination beliefs, as allegations

of compromised integrity appear on opposing sides of the debate. The integrity of Paul Offit, perhaps the leading pro-vaccine scientist, is called into question to support anti-vaccination beliefs:

[6.4] Paul Offit is a patent holder on vaccines. Do you really trust a man who makes money on vaccines to tell the complete truth about them?

But the same allegations are among the tactics used to dismiss the authority of Andrew Wakefield, the lead author of the retracted study that first suggested a relationship between the MMR vaccine and autism (as Nelson, 2010, has also noted):

[6.5] Wakefield accepted 50,000 pounds to be a consultant in an MMR litigation, which is the financial motive for his fraudulent research, as can be seen in the official ruling of the General Medical Council

Again, as we have noted, certain tactics may be more common on one side of the debate or another, as reason and authority more commonly support pro-vaccination beliefs, while emotional personal experiences more commonly support anti-vaccination beliefs. Nonetheless, there seems to be no tactic identified in the present data that is not employed at least to some degree in support of beliefs from opposing sides of the controversy.

Looking across the quotations cited here and in previous chapters, we may summarize certain tropes of evidence evaluation that the two sides of the debate seem to share. Opposing sides are motivated by personal experience, either of the disease or of a loved one's reaction to a vaccine. Opposing sides accuse the other of reasoning flaws, and often the same reasoning flaws. Opposing sides cite studies that support their position and discredit studies that disagree, and yet opposing sides also use facts as refutation without support or citation. Opposing sides accuse each other of fearmongering, and opposing sides engage in fearmongering. Each side demands particular evidence that the other side does not consider valid, as when vaccine scientists are called upon to "listen to the parents" or parents are called upon to accept the

consensus of scientists, even though scientists do not consider anecdotal evidence valid and such parents consider the scientific consensus to be compromised. Beyond accusing each other of compromised integrity, each side engages in personal insults about the intelligence of the other side.

This suggests that the use of similar tactics to reach opposite conclusions may derive from a kind of “fight fire with fire” approach to evidence. In other words, tactics that convince one side may suggest to another side how to convince them. For example, the use of science to support pro-vaccination beliefs suggests two means of defending anti-vaccination beliefs. One is to refute opposing beliefs with different science, as often happens. The other is to reject science as a legitimate authority. This suggests the need for a replacement authority, and hence even those who reject traditional authority nonetheless seem inevitably to call upon authority in some form. This does not seem to be unique to authority. Each side summons reason to attack the reasoning of the opposition, and the prevalence of personal anecdotes to support anti-vaccination beliefs has inspired many pro-vaccination advocates to suggest more personal, emotional messaging as a counter. In the end, the similarity of tactics may derive from the desire to convince others. It is possible that this behavior may be enhanced in comments sections, which often consist of arguments. It is also likely true that such behavior is endemic to issues of controversy such as this one. Notably, implicit in the use of similar tactics on opposing sides is a critique of the idea that those tactics work in reaching correct conclusions, since those tactics are used to reach directly contradictory conclusions.

Misinformation and Belief

In the foregoing analysis of beliefs about vaccine safety—what is believed and how—we are observing more than the formation of belief. To begin with, this is a study of a very particular

kind of belief in a very particular environment. It is an environment where the consensus strongly favors one side, but in which contradictory information is nonetheless easily available, along with a community of others seeking to reinforce the beliefs (on both sides.) Studies of other beliefs, such as religious belief or aesthetic belief, might offer different insights into belief formation. In the case of vaccine safety we also find beliefs *about* misinformation, which is to say beliefs about whether something is right or wrong. Hence a belief that vaccines are safe is also a belief that anything claiming vaccines are unsafe is misinformation, and conversely a belief that vaccines are dangerous is also a belief that evidence of vaccine safety is misinformation. A claim that “I have a belief about vaccine safety” is also a claim that “I know what is misinformation and what is not.”

This further suggests that while particular belief profiles resemble buffet meals, the process of their formation is more than merely a selection of beliefs. This study, since it does not directly observe beliefs in their moment of formation, observes something different than a choice between facts. It directly observes the justification of beliefs, a stronger stance than merely the selection of them. In observing justification, this study observes the affirmative assertion that a belief is correct or incorrect. One selects food from a buffet based upon expectations about it; one does not normally defend the selection. Indeed, this idea is embodied in the very idea of belief, at least as we have defined it as treating a proposition as if it were true. One selects food with the expectation it will be delicious, but need not thereafter treat it as if it is delicious. In Internet comments, however, we observe the defense of the selection, and furthermore the modes of argument through which such defenses are made, and the social and rhetorical structures in which those defenses are situated. This does not imply that Internet commenters change each other’s minds, nor that believers arrange different meals with each buffet visit, as neither appears

to be the case. Rather, implicit in the arguments collected in the data is the assertion of something as true, in defense of some opposition that it is not true, or vice versa. They are arguments about what is misinformation.

Hence the data collected for this study seems to depict a bidirectional relationship between misinformation and belief. On the one hand, misinformation does seem to affect belief. For example, when parents speak of their child having a vaccine reaction, they seem to be saying that this event caused them to believe something. On the other hand, belief seems to affect misinformation, since bias and previous experience seem to influence how something gets designated as misinformation. Arguments that the parents' experience misinforms them depend on a preexisting understanding of what is misinformation. Even if this understanding, based upon scientific testing and consensus, is better informed or somehow superior to the parents' understanding, it depends upon a determination of misinformation. If one does not believe the scientific consensus, then one might not believe that the parents' are misinformed. The belief affects the evaluation of misinformation. Hence it is not merely that misinformation affects what we believe, but that what we believe appears to affect how we understand misinformation.

Again, this is not the same as saying that all information is created equal, or that misinformation depends upon one's perception of it. Rather, regardless of whether something might be empirically right or wrong, that determination depends upon which beliefs guide the evaluation and provide the framework in which it can be understood.

Importantly, an understanding of belief in misinformation also provides insight into how misinformation is created and how it spreads. While some kinds of misinformation are created to deceive, and others are created accidentally, much misinformation is believed with good intentions and best efforts. This kind of misinformation is not created deceptively or

maliciously, but by someone who believes it to be true, with the intention of informing others about it. This also explains the rapid spread of much misinformation through social media, where a person first believes the information and then shares it in order to inform others.

Implications and Applicability

The applicability of this framework to other areas of misinformation or controversy probably varies. Since risk-benefit calculations are such a central aspect of vaccine safety considerations, the applicability will be strongest in areas where risk and benefit are important and weakest in areas where risk and benefit are less important. For example, people probably navigate most medical controversies, such as about the value and safety of organic food and genetically-modified organisms, through means similar to those described here. Their personal experience with food and the kinds of scientific and medical authorities they revere probably have a similar influence on the way they reason through the risks and benefits. With other debates, however, the risk-benefit element may operate differently. The climate change debate, for example, relies upon a comparison between the risks of climate change and the risks of economic regulation, so that a risk-benefit analysis is central to that debate as well. These risks, however, may be seen as less immediately personal than the risks of vaccines and diseases, but rather as risks to the environment and to future generations. To take another example, beliefs regarding the theory of evolution may involve considerations of the risk to one's religious beliefs, a consideration which may not be analogous to the consideration of vaccine safety. Also, for many conspiracy theorists, such as 9/11 "truthers" or holocaust deniers, the risks and benefits of holding such beliefs are much less obvious. Even considering Goertzel's (1994) findings that conspiracy theories are most common among those lacking power, the risk or benefit of belief in such conspiracies does not seem comparable to the risks and benefits of vaccines. Hence for a

description of belief formation or of misinformed belief generally, the centrality of risk and benefit in the present framework may need reconsideration.

The other tactics of evaluation – reason, personal experience and authority – may also apply broadly but operate differently in other areas that are considered misinformation. For example, although personal experiences such as extreme weather may influence climate change beliefs, the influence of personal experience upon reason may be weaker or different than it is with vaccine safety. Also, notably, the present framework does not easily account for the noted influence of political partisanship upon climate change beliefs, except to the extent that political affiliation constitutes an evaluation of authority and partisan bias resembles motivated reasoning. On the other hand, both personal experience and authority seem essential to beliefs about evolution, given the relationship between such beliefs and religious belief. Conspiracy theories are perhaps more fundamentally considerations of authority than anything, suggesting that a model of such beliefs might have similar elements but in a different relationship.

What may be common across all of these areas of belief, however, is the use of reason. Each of us imagines ourselves considering each piece of evidence and rationally deciding what to believe or not. The reasoning may not be rational or even reasonable, and it is often infected with other influences such as bias and emotion, but we nonetheless think of evidence evaluation as a rational, cognitive process. To the extent that beliefs arise from evidence evaluation and evidence evaluation relies upon or purports to rely upon reason, it would seem that it underlies evaluations of vaccine safety, climate change, evolution, conspiracy theories, etc. The influences upon that process of reason (personal experience, authority, or something else) and the outcome to which that reason is applied (risk, benefit, or something else) may vary across kinds of belief, but the observation of reason as a tactic for belief formation appears broadly applicable. The

notable exception to this may be religious belief, where faith is often considered superior to reason, but that is a wholly different kind of belief than the kind examined here, which is rooted in attempts to make empirical claims about the state of the world. To the extent that religion seeks to make empirical claims, it roots them in reason, and to the extent that it roots them in faith it does not, by definition, seek to make empirical claims.

For those interested in raising vaccination rates, this understanding of belief formation may have discouraging implications, as suggested by previous research that casts doubt upon the effectiveness of corrective information (Lewandowsky et al, 2012; Nyhan & Reifler, 2010; Nyhan et al., 2014). For example, one might presume that if only the unvaccinated and under-vaccinated understood the science, they would vaccinate fully. In the collected data, this argument repeatedly fails in the face of beliefs about the compromised integrity of the scientific research and the feeling that science ignores parents. It often is not the case that anti-vaccination beliefs are ignorant of the science, but rather that they reject it. A second common argument is that vaccines are a victim of their own success, and that if people understood the effects of the diseases, vaccination rates would rise. This argument overlooks the belief we have characterized as a denial of the premise of vaccination, in that people often draw upon their personal experience of the disease as having been mild. Even when outbreaks do occur, many believers justify them as failures of the vaccine rather than as the result of under-vaccination. A third common argument, that vaccines are for the “greater good” and that the unvaccinated endanger others, fails for similar reasons. Many parents do not feel persuaded by the suggestion that they must risk their own child for the benefit of anyone. At the heart of the “greater good” argument is a belief about the premise of immunization, i.e. that it is effective and that the diseases are dangerous. For parents who believe the vaccines are ineffective, that the risk of the disease is

low, or that the risk of the vaccine is high, the greater good argument will not persuade. The failure of each of these common arguments to increase vaccination rates seems less surprising with an understanding of the variety of vaccine safety beliefs and the ways in which they appear to form. As Kahan (2010) has put it:

The prevailing approach is still simply to flood the public with as much sound data as possible on the assumption that the truth is bound, eventually, to drown out its competitors. If, however, the truth carries implications that threaten people's cultural values, then holding their heads underwater is likely to harden their resistance and increase their willingness to support alternative arguments, no matter how lacking in evidence. This reaction is substantially reinforced when, as often happens, the message is put across by public communicators who are unmistakably associated with particular cultural outlooks or styles — the more so if such advocates indulge in partisan rhetoric, ridiculing opponents as corrupt or devoid of reason. This approach encourages citizens to experience scientific debates as contests between warring cultural factions — and to pick sides accordingly.” (p. 297)

It would seem that the issue is not merely that the various sides disagree with each other, but that they fundamentally misunderstand each other.

Appendix A
IRB Approval



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APPROVAL NOTICE
New Study

DATE:	8/31/2012
TO:	COLIN DOTY INFORMATION STUDIES
FROM:	NANCY LEVINE Chair, NGIRB
RE:	IRB#12-001170 Why do people believe misinformation?: How parents evaluate evidence about vaccine safety. Version: 08/04/12

The UCLA Institutional Review Board (UCLA IRB) has approved the above-referenced study. The UCLA IRB's Federalwide Assurance (FWA) with Department of Health and Human Services is FWA00004642 (IRB00000174).

Submission and Review Information

Type of Review	Expedited Review
Approval Date	8/30/2012
Expiration Date of the Study	8/29/2013

Regulatory Determinations

-- The UCLA IRB determined that the research meets the requirements for expedited review per 45 CFR 46.110 categories 6 and 7.

Documents Reviewed included, but were not limited to:

1025/12la.edu/WebIRB/Doc/0/OGGVM6P1MCGKFBG92DBNMKJSAA/romString.html

Document Name	Document Version
12-001170 recruitment letter.pdf.pdf	0.01
<u>12-001170 consent.pdf.pdf</u>	0.01

Important Note: Approval by the Institutional Review Board does not, in and of itself, constitute approval for the implementation of this research. Other UCLA clearances and approvals or other external agency or collaborating institutional approvals may be required before study activities are initiated. Research undertaken in conjunction with outside entities, such as drug or device companies, are typically contractual in nature and require an agreement between the University and the entity.

General Conditions of Approval

As indicated in the PI Assurances as part of the IRB requirements for approval, the PI has ultimate responsibility for the conduct of the study, the ethical performance of the project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the IRB.

The PI and study team will comply with all UCLA policies and procedures, as well as with all applicable Federal, State, and local laws regarding the protection of human subjects in research, including, but not limited to, the following:

Ensuring that the personnel performing the project are qualified, appropriately trained, and will adhere to the provisions of the approved protocol,

Implementing no changes in the approved protocol or consent process or documents without prior IRB approval (except in an emergency, if necessary to safeguard the well-being of human subjects and then notifying the IRB as soon as possible afterwards),

Obtaining the legally effective informed consent from human subjects of their legally responsible

representative, and using only the currently approved consent process and stamped consent documents, as appropriate, with human subjects,

Reporting serious or unexpected adverse events as well as protocol violations or other incidents related to the protocol to the IRB according to the OHRPP reporting requirements.

Assuring that adequate resources to protect research participants (i.e., personnel, funding, time, equipment and space) are in place before implementing the research project, and that the research will stop if adequate resources become unavailable.

Arranging for a co-investigator to assume direct responsibility of the study if the PI will be unavailable to direct this research personally, for example, when on sabbatical leave or vacation or other absences. Either this person is named as co-investigator in this application, or advising IRB via webIRB in advance of such arrangements.

Appendix B

Interview Instrument

- GET THEM TO EVALUATE EVIDENCE IN FRONT OF ME
- Questions about their peer group and their connection to it (testing for “cultural cognition” explained in Kahan paper)

Preliminary Questions

1. Has your child received an exemption from the vaccine requirements at school?
2. What vaccines has your child received?
 - a. [If applicable] Why those vaccines?
3. What vaccines has your child not received?
 - a. [If applicable] Why not those vaccines?

Research Behavior Questions

1. Do you tend to use the internet as a source of information?
 - a. Do you recall researching vaccine safety on the internet?
 - i. [If applicable] When do you think was the last time you researched vaccine safety on the internet?
 - ii. [If applicable] Do you recall how you used it in researching vaccine safety?
 - iii. [If applicable] Do you recall anything specific that you read on the internet about this? What was your opinion of what you found there? Why?
2. Can you describe generally how you would go about researching a topic like this?
 - a. Do you go to particular sites? Which?
 - b. Do you tend to follow links you find on a webpage you are reading?
 - c. Which search engines do you use?
 - d. Do you revise your search queries [explain if necessary]?
 - e. Do you ever use the searches suggested by the search engine [explain if necessary]?
3. Do you read about vaccine safety regularly? On the internet or elsewhere? Where?

4. Besides the internet, what other sources do you remember consulting for information about vaccine safety?
5. What would you say are the most reliable sources of information about vaccine safety? What would you say are the least reliable?
6. How would you say you decide what to believe on the internet?
7. In general, how do you think you decide what to believe?

Evidence Evaluation Questions

[Repeated with regard to each belief mentioned by the subject, then each belief NOT mentioned]

1. Have you done any research to decide whether [this belief] is correct?
 - a. [If applicable] What research did you do?
 - b. [If applicable] What did you find that supports [this belief]?
 - c. [If applicable] What did you find that disagrees with [this belief]?
2. [Repeated as to each piece of evidence they mention, then each piece NOT mentioned]:
 - a. Do you find [that evidence] convincing? Why or why not?
3. How confident are you about [this belief]?
4. What would change your mind about [this belief]?

Potential Additional Questions

1. Do you know anyone who has had measles? Whooping cough? Autism?
 - a. If so, what was their experience like?
2. How common do you think skepticism about vaccine safety is?
3. Have you ever had a bad experience with a health care professional?
 - a. Have you ever gotten bad advice from a doctor?
 - b. Have you ever been harmed by a health care professional?
 - c. Has your child ever been harmed by a health care professional, other than by vaccines?
4. What information are you not getting from health authorities? What questions are they leaving unanswered for you?
5. Do you feel that people are generally accepting of your beliefs about vaccines?
 - a. [If applicable] For the people who are not accepting, what do they not understand?
6. What is your understanding of herd immunity?

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