

## Chapter 15

# Gaining Scientific Knowledge from Others

**Abstract** This chapter explores how we gain knowledge from other people. In particular two of the primary ways that we come to have social evidence are explored. The first is the most prevalent form of social evidence: testimony. This chapter examines some of the best explanations of how it is that we come to have knowledge via the testimony of others. The second way that we come to have social evidence is by learning of disagreements. This chapter explores the epistemic significance of disagreement as it occurs in science. In particular it discusses how we should respond when we discover that someone disagrees with us about a scientific claim. When we discover that equally informed experts in an area of science disagree we should refrain from believing one side or the other is correct until we have further deciding evidence. When novices discover that experts disagree with them concerning a scientific claim, the novices should defer to the experts.

Our discussion up to this point has been predominately focused on individualistic aspects of scientific knowledge and of knowledge in general. The reason for this is twofold. First, epistemology has historically been, and largely continues to be, focused on the epistemic appraisal of individual agents and how such agents can come to have knowledge by way of their own individual cognitive faculties. Second, this investigation of individualistic aspects of knowledge provides a critical foundation for understanding key features of knowledge in general and scientific knowledge in particular. Despite the importance of grasping the primarily individualistic aspects of knowledge which we have hitherto discussed, it would be a mistake to conclude our exploration of scientific knowledge without delving into some of the social dimensions of epistemology.

The idea of a scientist working in isolation discovering the great secrets of the universe, such as when Isaac Newton came up with many of his ideas related to calculus, gravitation, and optics while away from Cambridge at his family's farm, is no longer the norm of science (Gleick 2004). Perhaps it never was. As Newton himself famously claimed, "if I have seen farther, it is by standing on the shoulders of giants" (Hawking 2002, p. 725). Although Newton may have done a lot of work on his own, it seems that even he depended on the work of others in important ways in coming to his own conclusions. Whether it was ever the case that science proceeded by way of lone researchers working in total isolation, it no

longer proceeds in this fashion. In fact, at least since the 1800s with the work of philosophers like John Stuart Mill and Charles Sanders Peirce, a thoroughgoing social understanding of science has been on the rise (Longino 2013).<sup>1</sup> The social nature of science is even more readily apparent since the emergence of “Big Science” in the latter half of the twentieth century. Big Science projects like the Manhattan Project and the Humane Genome Project involve large groups of scientists with differing areas of expertise working together on common research projects (Longino 2013).

Even setting aside Big Science, it is widely recognized that science is a distinctly social enterprise. In practice only some scientific results are checked by independent studies. “Many are simply accepted on trust . . . in science, knowledge grows by depending on the testimony of others” (Longino 2013, p. 7). Further, there are several features of science which make it particularly well suited to yielding knowledge of the world. As Alvin Goldman (1999, pp. 250–251) notes, many of these features are social in nature:

- The marshaling and distribution of resources to facilitate scientific investigation and observation.
- A system of credit and reward that provides incentives for workers to engage in scientific research and to distribute their efforts in chosen directions.
- A system of disseminating scientific findings and theories as well as critical assessments of such findings and theories.
- The use of domain-specific expertise in making decisions about dissemination, resource allocation, and rewards.

Undeniably, science is a social practice and scientific knowledge is social in important ways. Given this, a better grasp of some of the social aspects of scientific knowledge can facilitate a deeper understanding of NOS. Hence, the focus of this final part of the current book is on important social dimensions of scientific knowledge.

Before diving into the specific social features of scientific knowledge it will be helpful to first get a broad picture of the focus of social epistemology. That is, it will be helpful to very briefly consider what kinds of epistemic issues are considered particularly social. A helpful way of differentiating social epistemological issues is in terms of the agents involved (Goldman 2011). Our focus in the earlier parts of this book was predominately on the knowledge (and justification) had by individual agents. Of course, such knowledge often falls under traditional, individualistic epistemology, however, some key social epistemological issues can arise for individual agents. Typically, the knowledge of individual agents is social when it is based on social evidence—evidence that “concerns acts of communication by others, or traces of such acts such as pages of print or messages on computer screens” (Goldman 2011, pp. 14–15). Additionally, “social evidence can consist in other people’s doxastic states that become known to the agent” (Goldman 2011,

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<sup>1</sup>See in particular Mill (1859/2008) and Peirce (1868/1982, 1878).

p. 15). Very roughly, one way to have social knowledge is for S to come to know that  $p$  on the basis of information provided to her by others. This information from others can come through the acts of communication whereby various people engage with S or by way of S learning of the beliefs of others in some way other than their intentional communication of the information to her.

Another way that knowledge can be social is for the knowing agent to be a group agent (a collective entity), rather than an individual. For instance, if a jury knows that the defendant is innocent or if a corporation knew that dumping would cause harm, such knowledge is social knowledge.<sup>2</sup>

A final way for knowledge to be social is for that knowledge to be generated by an epistemic system. As Goldman (2011, p. 13) explains, “an epistemic system is a social system that houses a variety of procedures, institutions, and patterns of interpersonal influence that affect the epistemic outcomes of members.” The clearest examples of epistemic systems are “formal institutions with publicly specified aims, rules, and procedures” such as science and education (Goldman 2011, p. 19).

Although all three ways of generating social knowledge are important and worth exploring, we will limit our focus here to individuals’ use of social evidence to gain knowledge (the focus of the remainder of this chapter) and science as an epistemic system (the focus of the next chapter). The reasons for this are that the idea of group agents having doxastic attitudes over and above those held by the individual members of the group is controversial, and the knowledge had by group entities, if such a thing occurs, is not central to understanding NOS.<sup>3</sup> With these preliminaries out of the way, let us turn our attention to social evidence.

## 15.1 Testimony

There are a number of issues to get clear on when it comes to the first sort of social evidence that we will discuss, testimony, and the role that it plays in our knowledge in general as well as scientific knowledge in particular. Let us begin by getting clearer on what testimony is.

### 15.1.1 *What Testimony Is*

Often when we hear the word “testimony” we think of formal settings such as when a witness in a courtroom has sworn to give honest testimony concerning events she

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<sup>2</sup>See Bratman (1993), Gilbert (1989), Pettit (2003), and Searle (1995) for reasons to think that groups can have doxastic attitudes.

<sup>3</sup>See Quinton (1975), Rupert (2011), and Wilson (2004) for considerations against thinking groups can have doxastic attitudes that are not reducible to the attitudes of the members of the group. See List (2014) for helpful discussion of different kinds of group agents and the degree to which their attitudes may be reducible to those of their members.

observed (Audi 2011). Obviously, this sort of formal testimony is very important, and it can provide us with key social evidence in some settings. However, much of our social evidence comes from more informal testimony—testimony which occurs outside of a court of law. In fact, informal testimony is so pervasive and important to our epistemic lives that it seems true to say that “virtually everything we know depends in some way or other on the testimony of others—what we eat, how things work, where we go, even who we are” (Lackey 2011, p. 71).<sup>4</sup> Consider some of the things we know, or come to know, on the basis of testimony: our birth dates (after all, we do not remember being born), the average summer temperature of a country we have never visited, how to get to a restaurant in an unfamiliar city, and the list goes on and on. In each case we come to know these facts by way of the testimony of others. Perhaps we are told our birth dates by our families, we might read on a weather app that the average summer temperature of a particular country is  $n$  degrees, and a passerby might tell us how to get to the restaurant. What exactly is it that all of these instances of testimony have in common?

A tempting answer to the above question would be that they are all instances where someone else engages in an act of communication with us. Consequently, one might think that any act of communication from one person to another is an instance of testimony. This, however, is much too broad. There are times when we communicate with each other without the intention of sharing information. For example, if Laura is running a race and Bruce shouts at her “Yay Laura!”, Bruce is not testifying. In this case Bruce is merely expressing support for Laura. Now, Laura might come to know things by hearing Bruce’s shout, such as that Bruce wants her to win, but the knowledge that Laura gains from Bruce’s shout is not based on his “testimony” because he provided none. This would be an instance where someone gets knowledge from another’s speech act, but that knowledge is not itself testimonial. Another example of gaining non-testimonial knowledge from another’s speech act would be when Charlotte hears Chuck speak for the first time and comes to know that Chuck has a deep voice. Charlotte’s knowledge of the tone of Chuck’s voice comes from her hearing him speak, but it is not testimonial knowledge. Admittedly, in both of these cases we might think that the knower is relying on social evidence in the broad sense of social evidence—evidence gained from another person—however, for our purposes here we will focus on the most prevalent form of social evidence: testimony. So, we will need a more precise definition of testimony before we continue, such as: “a speaker’s making an act of communication—which includes statements, nods, pointing, and so on—that is intended to convey the information that  $p$  or is taken as conveying the information that  $p$ ” (Lackey 2011, p. 72).<sup>5</sup> Undeniably, this definition of testimony could be yet

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<sup>4</sup>Also see Adler (2014), Audi (2011), and Goldman (1999) on the prevalence of testimony in our epistemic lives. Goldman points out that this sort of epistemic practice is not only ubiquitous throughout human cultures, it also occurs frequently among many non-human animals to some extent.

<sup>5</sup>See Lackey (2008) for a more complete discussion of how to best define testimony.

more precise, but for our purposes it will suffice. Now that we have a grasp of what testimony is, let us consider how it works.

### ***15.1.2 How Testimony Works***

Alvin Goldman (1999, p. 104) aptly notes that there seem to be four stages which occur when acts of testimony add to the overall knowledge of a social group: “(1) discovery, (2) production and transmission of messages, (3) message reception, and (4) message acceptance.” Let us consider a simple example in order to illustrate this. Rosa and Evelyn have shipwrecked on a deserted island. They have decided that their first priority is to find water. They agree that it will be best to try different routes and reconvene on the beach in an hour. Rosa discovers a clear spring close to the path that she has taken (stage 1). When Rosa and Evelyn meet up on the beach Rosa begins describing the spring and its location to Evelyn (stage 2). Evelyn listens and understands what Rosa is saying (stage 3). As a result, Evelyn believes that there is a spring where Rosa says (stage 4).

Here is one more example to help make the stages of testimony clearer. Clark is an investigative reporter for the *Daily Planet*. Late one night Clark discovers that Luther Industries is dumping barrels of waste into the harbor (stage 1). Clark writes up an article describing the actions of Luther industries, which his editor puts in the Sunday edition of the *Daily Planet* (stage 2). Lois and several other readers of the newspaper read Clark’s article in the *Daily Planet* on Sunday morning (stage 3). After finishing the article, Lois and several others believe that Luther Industries has been dumping waste in the harbor (stage 4).

Although the four-stage model of testimony Goldman offers is perhaps a bit simplistic, it is helpful for getting clearer about how testimony works when it leads to increased social knowledge. It seems clear that when all of the stages of the process are completed well, testimonial knowledge is gained. And so, social knowledge is increased.

Goldman’s four-stage model also helps to make it clear that there are various places where testimony can go wrong, i.e. fail to lead to knowledge. As we can see from the model, or even from thinking about testimonial exchanges in a less formal fashion, there are two primary ways that testimony can go wrong. First, the testifier can be incompetent in some way. For instance, Rosa might mistakenly take a mirage to be a spring full of fresh water or Clark might misread the names on the trucks dumping waste, and so mistakenly think that Luther Industries is dumping waste. Clearly, testimony can go wrong when the testifier is mistaken in what she reports. Second, the testifier can know the truth of the matter in question, but decide to lie or deceive. Unfortunately, it is not difficult to come up with cases where testifiers have a motivation to be dishonest in the things they say.

In light of some of the ways that testimony can go wrong one might worry that skepticism about relying on testimony will arise. After all, it seems that in any instance where someone testifies to us that  $p$  it could be that her report is

false—either because she is merely mistaken or because she is trying to deceive us about  $p$ . If these are always possibilities that we face when we receive another's testimony, one might worry that we are never justified in accepting what we are told. Clearly, if we cannot justifiably accept the testimony of others, then the vast number of things we believe on the basis of testimony would fail to constitute knowledge. This is a very troubling conclusion indeed.

Fortunately, we have good reason to think that such a far-reaching skepticism of testimony is unfounded. For one thing, there are ways we can help determine that these skeptical possibilities do not obtain. For instance, the speaker might convey her testimony in a way which makes it clear that she has expertise on the subject—consider how your physician tells you about various options you have concerning medications. She does so using specific jargon which suggests her expertise, the setting in which she provides you the testimony is one that gives evidence that she is well-informed, and so on. Also, various observable characteristics of a speaker may help us to determine her sincerity with respect to what she asserts—we tend to pick up on things like “her tone of voice, her facial aspect, and her body language” (Goldman 1999, p. 108). All of these things can give us reason to think that she is testifying honestly. Of course, these are not perfect indications of accurate and honest testimony, but they do help us rule out egregious violations.

In addition to methods that we can use to help determine the quality of a speaker's testimony there are also reasons to think these skeptical possibilities do not generally obtain. First of all, there is simply the empirical fact that, overwhelmingly, testimony tends to be truthful (Adler 2014). Some argue that the reason for this is evolutionary. They claim that there are credible evolutionary reasons for thinking that humans have evolved with dispositions to be truthful most of the time (Goldman 1999). Another plausible explanation of this comes from consideration of the nature of communication itself. Plausibly, it is a presupposition of communication that participants are, at least for the most part, truthful (Lewis 1969; Schiffer 1972). While not all situations are ones in which the norm is to be truthful such as when a marketing campaign is designed to convince you of the superiority of a particular brand, we have information about which domains are the ones in which truthfulness is not the norm (Adler 2014). So, we can typically recognize whether we are in a setting where the norm is for testimony to be trustworthy or not. In addition to these presuppositions and our, perhaps natural, disposition to tell the truth there are also rewards and punishments in our social settings which encourage accurate, honest testimony (Adler 2014; Goldman 1999). This is particularly clear in the way that reputation plays a significant role in the scientific community (Adler 2014). The emphasis science places on things like the replication of experiments and the peer review process for publication also helps to encourage truthful and well-informed testimony when it comes to sharing scientific knowledge (Shatz 2004).

Given all of the methods we have in place in social settings for ensuring accurate testimony, we have good reason to think that generally trusting the testimony of others is likely to lead us to the truth. Nevertheless, we should “always engage in some assessment of the speaker for trustworthiness” because “to believe what is asserted without doing so is to believe blindly, uncritically” (Fricker 1994, p. 145).

By doing this we help to ensure that we are not led astray in the cases where the testimony is not genuine.

Although we have seen that there is good reason to think we should generally trust testimony because of the ways in which it is typically constrained and our natural dispositions, it is an open question whether one has to have this information about testimony before she can rely on testimony to gain knowledge. So, we are now faced with an important question: can we come to know that  $p$  simply because someone tells us that  $p$ , or must we have evidence from other sources like perception, memory, and reasoning to support our trusting the speaker's testimony when she tells us that  $p$ ? In other words, "is testimony an autonomous source of epistemic authority" (Adler 2014, p. 1)? It is toward this, the central question of the epistemology of testimony, that we will now turn our attention.

### 15.1.3 *How Testimony Provides Knowledge*

Most views concerning testimonial justification/knowledge fall into two camps. Each side traces its origin to the writings of a major figure in the history of philosophy—reductionists trace their view to David Hume and non-reductionists (sometimes called "anti-reductionists") to Thomas Reid. Very roughly, reductionists answer the question concerning the autonomy of testimony as an epistemic source negatively—"testimony cannot provide justification or knowledge independently of other sources like perception, memory, and inductive inference". Non-reductionists answer it positively—"testimony can provide justification/knowledge on its own". Although for our purposes it does matter which camp has the truth of the matter, it will be worth briefly considering both views and some of the major challenges that each face because doing so will help to add depth to our understanding of testimony.

Let us start with reductionism. It will be helpful to first define reductionism more precisely. There are actually two versions of reductionism, which Jennifer Lackey (2011) refers to as "global reductionism" and "local reductionism". Global reductionism is the view that the justification of relying on testimony as a general source of belief "reduces to the justification of sense perception, memory, and inductive inference" (Lackey 2011, p. 74). Local reductionism, the more prominent of the two kinds of reductionism, is the view that in each particular case of testimonial belief the justification for that belief "reduces to the justification of instances of sense perception, memory, and inductive inference" (Lackey 2011, p. 75). More simply, the idea is this: global reductionism claims that you have to be justified in believing that testimony *in general* is reliable in order to have justified beliefs/knowledge on the basis of a particular instance of testimony whereas local reductionism claims that you only need to have justification for accepting the *particular* testimonial report in question in order to have a justified belief/knowledge on the basis of that testimony. To see the difference consider the following: Thelma believes that  $p$  on the basis of Tim's testimony that  $p$ . According to global reductionism, in order for Thelma's belief that  $p$  to be justified she must be justified in believing that testimony in general

is reliable, i.e. she must be justified in believing that most instances of testimony are accurate. According to local reductionism, Thelma does not have to be justified in believing that testimony in general is reliable in order to justifiedly believe/know that  $p$  on the basis of Tim's testimony. Instead, local reductionism only requires that Thelma be justified in thinking that Tim's testimony in this instance is likely to be accurate.

The major objection that is often put forward against reductionist views is that ordinary people simply do not have enough information to have the positive reasons required to have justification for accepting either that testimony in general is reliable or that a particular instance of testimony is reliable.<sup>6</sup> Perhaps the most formidable form of this objection is what has been called the "infant/child objection" (Lackey 2005). This objection is simply the idea that children and infants seem to learn a lot about the world strictly via testimony. Furthermore, it seems that they can gain this knowledge without first having a sufficiently large non-testimonial basis for accepting the reliability of testimony. This seems to run counter to the claims of reductionism though. So, the objection claims that reductionism cannot be correct about testimony.

Now let us take a look at the other side of the debate. Non-reductionism is the view that testimony is like sense perception, memory, and reasoning—it is a basic source of justification/knowledge. As Lackey (2011, p. 73) explains, "non-reductionists maintain that, so long as there are no relevant undefeated defeaters, hearers can be justified in accepting what they are told *merely* on the basis of the testimony of speakers." With this more precise characterization of non-reductionism in hand we can characterize the general dispute between reductionists and non-reductionists quite simply. Reductionists think that in order for S's belief that is based on testimony to be justified/knowledge S has to have reasons for thinking that she can trust testimony (either in general or in this particular case), but non-reductionists think that S's testimonial belief is justified so long as she does not have reasons to distrust the testimony she has received. Hence, non-reductionists hold that one does not need positive reasons for thinking that testimony is trustworthy in order to gain testimonial justification/knowledge, one simply has to lack reasons for thinking that testimony is not trustworthy.

The primary objection to non-reductionism is that it makes testimonial justification/knowledge too easy to come by.<sup>7</sup> It is claimed that non-reductionists "sanction gullibility, epistemic irrationality, and intellectual irresponsibility" (Lackey 2011, p. 75). The problem with non-reductionism is that according to this view if one were to simply believe everything she saw on television, she would be justified in doing so as long as she did not possess positive reasons to be distrustful of the information she is given. Opponents of non-reductionism claim that this is ridiculous. It seems that one needs some positive reasons for trusting the information she gains from

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<sup>6</sup>In addition to this objection there are others which are raised against each particular kind of reductionism. For more on these see Adler (2014) and Lackey (2011).

<sup>7</sup>For additional objections and discussion see Adler (2014) and Lackey (2011).

other people. If such positive reasons are not required, then one could justifiably believe on the basis of the testimony of “randomly selected speakers, arbitrarily chosen postings on the Internet, and unidentified telemarketers” (Lackey 2011, p. 75). Unfortunately, this seems to be exactly the sort of thing that is licensed by non-reductionism.

Of course, supporters of both reductionism and non-reductionism attempt to respond to these objections as well as the various other challenges faced by their preferred views. Some argue that the objections facing reductionism and non-reductionism show that both views are unacceptable. They maintain that we should look to hybrids of reductionism and non-reductionism or to alternative approaches to both views in order to adequately capture the truth about testimony.<sup>8</sup> We will not concern ourselves with attempting to settle the debate between reductionists and non-reductionists (or supporters of hybrid views and alternative approaches) here. Simply understanding the issues that are of concern to these various theorists is sufficient for our purposes. However, before turning our attention to another key kind of social evidence and the important epistemological questions that consideration of it raises, we should briefly explore a particular account of testimonial justification/knowledge. This account of testimony fits quite nicely with the explanatory account of knowledge we have developed in earlier chapters.

A plausible account of testimony relies on inference to the best explanation (IBE). The idea behind this approach to testimony is quite simple. S is justified in believing that  $p$  on the basis of T’s testimony when the best explanation S has for T’s asserting  $p$  is that  $p$  is true.<sup>9</sup> Returning to our above examples, Evelyn is justified in believing that there is a spring near the path that Rosa took so long as the best available explanation she has for Rosa telling her this is that it is true that there is a spring near the path. Similarly, Lois is justified in believing that Luther Industries is dumping waste in the harbor just in case the best available explanation of the *Daily Planet* printing the article saying this is that it is true that Luther Industries is dumping waste in the harbor. It is not difficult to see how this would equally apply in scientific settings—we are justified in accepting the articles we read in *Nature* or *Science* because the best explanation of why the empirical findings reported in such articles appear in these journals is that they are accurate, we are justified in accepting what the professors in the physics departments at reputable universities tell us about General Relativity because the best explanation for why they are telling us this is that it is true, and so on. This IBE account seems to offer a straightforward account of testimonial justification/knowledge which fits very well with the view of scientific knowledge we have been exploring in earlier chapters.

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<sup>8</sup>See, for example, Goldberg (2008), Faulkner (2000, 2007), Hinchman (2005), Lackey, (2008), Lehrer (2006), and Moran (2006).

<sup>9</sup>Fricker (1995), Harman (1965), Lipton (2007), Malmgren (2006), and Schiffer (2003) all provide considerations in support of this sort of view of testimony.

Now one might worry that the IBE account of testimony faces a serious problem because it appears to be a kind of local reductionist theory. As such, it would seem to face the infant/child objection described above. While it is true that the IBE account of testimony is plausibly considered a local reductionist theory because it requires S to have positive reasons for accepting any particular instance of testimony, it is not clear that the infant/child objection poses a serious problem for it. The IBE account of testimony does not seem to require nearly as much information as those pressing the infant/child objection typically presuppose. All that is required is that S be such that the truth of what she is told is the best explanation she has for why she is told this. It is not unreasonable to think that unsophisticated agents such as infants and children could have such reasons. After all, as we noted in Chap. 10, even very small children are fairly adept at evaluating explanations. Additionally, there is evidence that children keep track of both the reliability of informants and of informants' standing as testifiers in the community (Harris and Corriveau 2011). Finally, if the IBE view of testimony only requires that  $p$ 's truth be the best *available* explanation of why T asserts  $p$  in order for S to be justified in accepting T's testimony that  $p$ , it is likely that infants and children may be in position to have a lot of testimonial knowledge. At a very young age the truth of what others testify may be the only explanation that children have available for the testimony of others. As children develop the cognitive capacities to have alternative explanations available for why someone would assert that  $p$  it is likely that they also accumulate information concerning the reliability of informants. While these considerations are far from decisive, they do at least show that an IBE approach to testimony is plausible. They also show that such an account may be able to overcome the major challenge facing reductionist views. The IBE approach to testimony is not required by the explanatory account of scientific knowledge that we have developed throughout the previous chapters, but it does fit quite nicely with it.

## 15.2 Disagreement

Disagreement is a fact of our lives. People disagree with us about all sorts of things: religion, politics, philosophical theories, and many other issues. What is so important about the fact of disagreement for our purposes is that discovering disagreements can provide us with an important kind of social evidence. In many cases we gain evidence of disagreement by way of testimony. For example, Derek can gain evidence of disagreement when Hansel tells him that he disagrees with him about a particular issue. It is possible to gain evidence of disagreement in other ways too. Derek might learn of Hansel's disagreement with him not via Hansel's testimony, but instead by observing Hansel's behavior in various situations. How exactly we come to discover the disagreement is not all that important—what matters is our awareness of the disagreement and what it means for the justification we have for the things we believe.

There are some cases where the epistemic impact of discovering disagreement is pretty obvious. As Adam Elga (2007, p. 478) explains, “There are experts and gurus, people to whom we should defer entirely. There are fakes and fools, who should be ignored.” The idea that Elga is expressing seems both plausible and widely shared. When we recognize that we disagree with someone who is an expert on a topic that we are not, we should generally defer to her opinion on the topic (Carey and Matheson 2013; Conee 2009; Kornblith 2013; Matheson 2015b). Alternatively, when we recognize that we disagree with someone who is a largely uninformed novice, much less a fake or fool, on a topic on which we are experts or at least much better informed, we should generally be unimpressed by her difference of opinion (Frances 2014).

Not all cases of disagreement are this easy to adjudicate though. The epistemological literature on the significance of disagreement has predominately focused on cases where the justificatory impact of disagreement is less clear—disagreements among epistemic peers (individuals who are in equally good epistemic positions to arrive at the truth of the disputed matter). There are a variety of theories concerning the impact on one’s justification for believing that  $p$  when she discovers that an epistemic peer disagrees with her. These views fall along a spectrum from very “conciliatory”—discovering disagreement should make one much less certain of  $p$ ’s truth—to very “steadfast”—discovering disagreement should have little to no effect on one’s confidence in  $p$ ’s truth (Christensen 2009, p. 756).<sup>10</sup>

Although there is much of value that can be gleaned from exploring the burgeoning epistemological literature on disagreement, examining it in detail will not be especially helpful for our purposes. One of the primary reasons for this is that the sorts of cases focused on in the epistemological literature tend to involve extremely idealized disagreements. The disagreements that are typically discussed are those which occur between only two individuals who are perfectly equal with respect to their epistemic positions concerning their dispute. As Jonathan Matheson (2015a, p. 5) aptly notes, “there is good reason to believe that peer disagreements [of the sort the epistemological literature tends to focus on] simply don’t occur in the actual world.” While there are numerous disagreements in the real world, “typically there is at least some epistemic advantage held by one of the parties: one of them has a little more evidence, one of them has thought about the issue a little more, one of them is a little more open-minded, and so forth” (Matheson 2015a, p. 5). So, the sort of idealized disagreements that the epistemological literature focuses on are not likely to be encountered.

A consideration of real world disagreements will be much more helpful for our purposes. The idealization that is perhaps farthest from how things actually are in the world is the restriction of disagreements to those occurring between

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<sup>10</sup>For a sampling of the many theories of the epistemic significance of disagreement which have been put forward recently see Christensen and Lackey (2012), Feldman and Warfield (2010), and Machuca (2013). See Matheson (2015b) for in-depth critical discussion of many of the key points of contention among theories of the epistemic significance of disagreement.

just two individuals. In the disagreements we actually encounter though, “we are typically aware of a vast multitude of opinions” (Matheson 2015b, p. 125). Such disagreements are widespread in a variety of domains, even the sciences (Christensen 2009; Kornblith 2013; Matheson 2015b). Fittingly, our focus will be on the sort of evidence that is gained from disagreements in the sciences and how we should respond to that evidence.

When it comes to disagreements no intellectual endeavor is immune—even the sciences. Despite this fact, disagreement within the sciences is different than the disagreements which arise in politics, religion, philosophy, and countless other domains in a very important way. Disagreements in the sciences “tend to be resolved over time. Opinions in the sciences tend to converge, and . . . there is a great deal of reason to believe that these opinions tend to converge to the truth, or at least to closer and closer approximations to the truth” (Kornblith 2013, p. 261). As a result, in the sciences we tend to see “an ever-increasing body of accepted opinion among experts . . . there are large bodies of well-established results, and smaller areas of dispute”—areas of dispute which for the most part tend to be resolved as time progresses (Kornblith 2013, p. 266). This, at least upon a cursory examination, seems very different than what we find in other areas such as politics, religion, and philosophy. Disagreements in these domains appear very longstanding and perhaps intractable. Whether or not these other disciplines are worse off than the sciences with respect to disagreement is not all that important for our purposes. What is important is that the sciences tend to be *progressive*—resolving disagreements and coming closer to the truth over time. The progressive nature of science and the consensus of experts in the sciences over time give us some reason to think that the opinions of experts in the sciences are trustworthy. It seems that “experts in the sciences are highly reliable. Individual experts tend, to a very high degree, to form true, or at least approximately true, beliefs about the matters they investigate. It is for primarily this reason, of course, that opinions within the sciences tend to converge over time” (Kornblith 2013, p. 268). Recognizing these facts has important ramifications for the significance of disagreements concerning the sciences.

Considering the following simple case helps to illuminate the most basic lesson of the reliability of experts in the sciences and the way that disagreements in the sciences tend to go:

Elisa is an expert in electrical engineering. Ned is not. He is a complete novice. Elisa believes some particular claim about electrical engineering,  $p$ . Ned does not believe that  $p$ , in fact, he believes not- $p$ . Elisa and Ned have a conversation and discover that they disagree about  $p$ .

What happens to the justification that Elisa has for believing that  $p$  and the justification that Ned has for believing that not- $p$  once they discover their disagreement? Assuming that Elisa and Ned are both aware of their comparative expertise, it seems clear that Elisa should simply continue to believe that  $p$  pretty much just as firmly as she did before she discovered that Ned disagreed. Ned, however, should drastically change his doxastic attitude—he should either now believe that  $p$ , as Elisa does, or at the very least he should greatly reduce his confidence in not- $p$ .

The situation between Elisa and Ned is analogous to our position with respect to at least some areas of science—unless one is an expert in that particular scientific field, she will be in much the same position as Ned when it comes to disagreeing with the experts. When it comes to disagreement with experts in science a good general rule is that novices should simply defer to the opinion of experts. After all, as we have already noted, science has an excellent track record of converging on truth because experts in science tend to be very reliable at forming true beliefs on matters in their fields of specialty.

In fact, the advice to defer to the experts seems equally applicable to situations in which the subject is not a complete novice, but an informed layperson. For instance, if Ivan, who is reasonably well informed on matters of electrical engineering, discovers that he disagrees with Elisa about  $p$ , he should defer to her opinion. At a minimum Ivan should become considerably less confident of  $\text{not-}p$ . This becomes even clearer when we consider a situation where not only Elisa disagrees with Ivan, but the majority of experts in the field hold Elisa's position. In such a case it seems clear that Ivan should defer to the experts. This is true even if Ivan has examined the evidence concerning  $p/\text{not-}p$  himself and concluded that it supports  $\text{not-}p$ . Ivan is not an expert, so he knows that Elisa and the other experts are in a better position to evaluate the evidence than he is. In light of this, he should defer to their opinion.

The advice of deferring to the experts is applicable even to experts themselves. Of course, if Elisa, an expert electrical engineer, finds herself in a disagreement about astronomy with Alexis, an expert astronomer, she should defer to Alexis' opinion on the issue. It seems plausible that even if Elisa believes a particular claim about electrical engineering,  $p$ , but later discovers that the vast majority of electrical engineers disagree with her, she should defer to the opinion of the majority of experts (Kornblith 2013). After all, these other expert electrical engineers are each approximately as knowledgeable as Elisa is, so each one is about as likely to arrive at the truth concerning  $p$  as she is. The odds that the vast majority of experts are correct and Elisa is not in this case are very high. Consequently, the general rule of deferring to the majority opinion of the experts in the sciences when one disagrees (and even when one is simply coming to form an opinion about a topic in the sciences) seems to apply across the board to novices and experts alike.

Of course, there are exceptions and complications to this rule. For example, if Elisa knows that the majority of experts in her field have been bribed by a corporation to report what the corporation wants about  $p$ , then it seems that she should not defer to their opinion. Similarly, if Elisa knows that the experts are disagreeing with her while intoxicated at a party for experts in electrical engineering, then deferring to their opinion at that time is probably not reasonable. Further, if Elisa knows that she has made a new discovery which bears on the issue and has not yet shared the discovery with her colleagues, she has reason to resist deferring to the majority opinion of the experts.

In general, when one has good reason to think that the expert is not exhibiting her expertise in a particular instance or if there is reason to think that one has key information which the expert lacks, there is reason to be less deferential to expert opinion. Additionally, whether one should defer to the experts can be less clear in

cases where the particular science contains a very small number of experts or it is not clear that the experts are independently arriving at their conclusions (perhaps because the experts are all students of one prominent scientist). Finally, there are cases where it is not clear that one should defer to the majority of expert opinion because it is not clear that the majority holds the lion's share of the expertise in the field. For instance, it could be that when one is considering whether to believe that  $p$  95 % of the experts believe that  $p$  and 5 % believe not- $p$ . In most cases the epistemically appropriate thing to do is to believe that  $p$ —even if one discovered the proportion of expert opinion after having already formed the belief that not- $p$ . However, if the 5 % of experts who believe that not- $p$  “are generally considered the epistemic superiors” of the 95 % of experts who believe that  $p$ , it is not clear that one should adopt the opinion of the majority because the minority is composed of the very best of the experts (Frances 2014, p. 72). Consequently, the advice to believe what the majority of experts believe does not always hold. Yet, despite the sorts of exceptions and complications that we have seen, more often than not we should defer to expert opinion in the sciences. Hilary Kornblith (2013, p. 267) quite reasonably suggests that when it comes to the sciences “even the experts should have opinions which are, *ceteris paribus*, dictated by the dominant opinion within the field. Where there is no dominant opinion, there is good reason to withhold belief.”<sup>11</sup>

Before concluding this section it is worth noting that while the rule to defer to the opinion of the majority of experts in the sciences is an excellent epistemic rule, there may be important pragmatic reasons for scientists to not defer to other experts. It may be that scientists are better able to conduct research when they believe that their theories are true even when the majority of experts disagree. Perhaps believing that one's theory is true provides the necessary motivation to press through difficulties and setbacks. As we will see in the next chapter, science has the best prospects of discovering the truth when a variety of methods are employed and a variety of theories explored. As a result, it may be good for our overall progress in science for scientists to continue to believe that their theories are true in defiance of the opinion of the majority of experts. This means that there may be *pragmatic* reasons for continuing to believe a theory in the face of disagreement with the majority of experts. Nevertheless, when it comes to what we *epistemically* ought to do, we should to defer the majority of experts in the sciences.

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<sup>11</sup>Whether the rule of deferring to the majority opinion of experts should be a more general epistemic rule which extends beyond the sciences is far from clear. See Carey and Matheson (2013) and Matheson (2015b) for some considerations for thinking that this rule should be fully general.

## 15.3 Conclusion

In this chapter we have explored some of the central issues related to the most prevalent form of social evidence: testimony. We have seen some of the best explanations of how it is that we come to have knowledge via the assertions of others. We have also examined the epistemic impact of another form of social evidence: evidence of disagreement. Understanding the nature and epistemic import of these forms of social evidence is important for understanding NOS because science is a social activity in which progress greatly depends upon sharing knowledge with one another and discovering how to epistemically best respond to evidence of disagreement. In the next chapter we will delve more fully into the social nature of scientific knowledge by exploring science as an epistemic system which generates much knowledge about the world.

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