Collaborative Scientific Knowledge and Testimonial Justification

by

Angella Yamamoto

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Arts
in
Philosophy

Waterloo, Ontario, Canada, 2018

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Is it possible to gain justified scientific knowledge from the testimony of a collective of scientists? In this thesis, I discuss whether or not it is possible to use current theories of testimonial justification for collective scientific knowledge. Our current theories on testimony and testimonial justification give us the conditions for when it is justified to acquire knowledge from someone or something else. However, these theories on testimonial justification focus on instances of testimony between individuals. That is, current theories on testimony explain when there is testimonial justification for knowledge that passes from one individual testifier to an individual recipient. In collective scientific knowledge, I describe two kinds of testimony. There is not only testimony by the collective but testimony within the collective. My discussion comes to the conclusion that while current theories on testimonial justification could be used to describe the kinds of testimony in collective scientific knowledge, there is still more work to do. Current theories of testimonial justification do not account for the interaction between the kinds of testimony.

Acknowledgements and Thanks

I acknowledge that this work was completed in large part on the University of Waterloo Campus and surrounding area which is located on the Dish With One Spoon Territory: the traditional lands of the Attawandaron Nation, Anishinaabek (Three Fires Confederacy and Mississauga), Rotinonshón:ni (Six Nations Confederacy), Wyandot People, and the Métis Nation of Ontario. The University of Waterloo is located specifically on Block 2 of the Haldimand Tract.

I want to thank the graduate students and faculty from the Department of Philosophy. I would not have been able to complete this work eventually without their support and guidance. In particular I would like to thank my supervisor, Dr. Patricia Marino, and my readers, Dr. Doreen Fraser and Dr. Carla Fehr.

Most importantly I want to thank my family (including my pets: Sabert, Tola, Fin, Sid, and Nix) Bradley Scales, Erin Yamamoto, Sandy Yamamoto, and Tuk Yamamoto. Without their love and support I would not be here nor would I have been able to complete this thesis. It is because of you that I am proud to present my work in the following pages.

Dedication

This MA Thesis is dedicated to my father, Douglas Takeshi Yamamoto. Without him, I would not have been able to complete this thesis. He not only provided for me but also continually encouraged me to learn as much as I can. It is with great sorrow that he will not be able to read this thesis despite being the reason for its creation. I will always love you daddy, miss you and hope this work would have made you proud.

Table of Contents

Introduction **1**

1 The Need for Social Scientific Knowledge **12**
1.1 A Brief Critique of Logical Positivism 14
1.2 A Brief Critique of Wholism 16
1.3 Helen Longino on Science as Social Knowledge 18
1.4 Helen Longino's Critical Contextual Empiricism 22
1.5 Silvia Tossut's Social Scientific Knowledge 27

2 Collective Scientific Knowledge **31**
2.1 Kristina Rolin's Joint Commitment 32
2.2 Hyundeuk Cheon's Irreducibly Collective Knowledge vs Jointly Committed Knowledge 37
2.3 Jeroen de Ridder on Scientific Knowledge as Collective Scientific Knowledge 44

3 Testimonial Justification in Epistemic Testimony **52**
3.1 Non-Reductionist Approach to Testimonial Justification 55
3.2 Reductionist Approach to Testimonial Justification 59
3.2.1 Global Reductionist Approach 60
3.2.2 Local Reductionist Approach of Testimony 62
3.3 Jennifer Lackey on Dualism 64

4 Testimony of Collective Scientific Knowledge **70**
4.1 Collective Scientific Knowledge and Non-reductionism 72
4.2 Collective Scientific Knowledge and Reductionism 81
4.3 Collective Scientific Knowledge and Dualism 88

Conclusion **93**

Introduction

The purpose of this thesis is to determine if current theories on testimonial justification can be used when it comes to testimony of collective scientific knowledge. I identify two kinds of testimony in collective scientific knowledge. One kind of testimony is the testimony of the collective. The other kind of testimony is the testimony of the individuals within the collective. I find it possible to use the current approaches to testimonial justification with respect to each kind of testimony but find no way to judge the interaction between the two. In what follows I will briefly outline the chapters to come.

In the first two sections of Chapter One, I present Helen Longino's convincing discussion of the issues with early philosophy of science theories. Longino focuses on logical positivism and wholism as the two main approaches to philosophy of science prior to their analysis. Longino argues that logical positivism is not useful for discussing evidential relations in scientific knowledge because it does not provide a way to connect the data and the hypothesis and/or theory. Wholism, on the other hand, is not fluid enough to account for changes in evidential relations without collapsing the entire underlying theory. The reason Longino gives for these theories falling short is that they do not account for social influences on science.

In the third section, I review Longino's arguments for science as social knowledge. Social

influences on science include the context and situation in which the science is done. For example, context considerations include what kind of materials are available, how much funding there is, and where it comes from. Situation considerations could be the religious background, gender, upbringing, country in which the science is being done, language used, and/or analogies used. All of these situations influence how science is approached, what one considers scientific, and what definitions are used. History and background assumptions must be considered as well. History determines what is considered acceptable in the scientific field and provides knowledge and information. Background assumptions are those assumptions that are made in order to understand the science, terms, methods, etc. that occur. Background assumptions become extremely important to Longino's social scientific knowledge theory, critical contextual empiricism.

The fourth section of Chapter One explains Longino's social scientific knowledge theory, critical contextual empiricism and its advantages. Critical contextual empiricism is not restricted like logical positivism to only considering observable data and a hypothesis or theory. Instead critical contextual empiricism acknowledges the role that background assumptions and information plays in classifying data as evidence. Acknowledging these background assumptions and information also explains why, unlike wholism, critical contextual empiricism is able to use the same set of data for multiple incompatible theories at the same time. In being less restrictive and able to consider social factors, critical contextual empiricism is a better way to create scientific knowledge. Not only is critical contextual empiricism better at creating scientific knowledge, it is open to considering previously ignored avenues of thought.

In brief, Helen Longino's critical contextual empiricism lays out requirements for when

content is epistemically acceptable.[1] For Longino, it is not only important that there is data supporting the content in question but that this content has gone through appropriate criticism.[2] In order for this criticism to take place, a particular kind of community must exist.

According to Longino, this community must have "venues for criticism, uptake of criticism, public standards, and tempered equality of intellectual authority."[3] Venues are a place for the community to evaluate and decide what will become acceptable content. It seems open to the community to choose what venue(s) it will use. The uptake of criticism is a two way street that is made possible because of the venues. The public standards let everyone know how the community is organized and what will be considered acceptable by the community. Finally, the tempered equality of intellectual authority requires that a certain level of epistemic equality is present. This means that any view that is of similar intellectual authority or expertise should be considered.

Being able to meet all of these standards to their highest degree is unlikely. Therefore, any given community will be more or less successful at meeting these standards. The more a community meets the standards, the more the content criticised by that community becomes epistemically acceptable. Similarly, the less a community is able to meet the standards, the less the content criticised by the community is epistemically acceptable. This view becomes helpful later when we look for a way to determine the reliability of content.

Longino's account of social scientific knowledge is not the only one available. In the

1. Helen E. Longino, *The Fate of Knowledge* (Princeton University Press, 2002), 135.
2. Ibid.
3. Ibid.

final section of Chapter One, I present Silvia Tossut's argument for social scientific knowledge based on a shared intention of a truth-orientated epistemic goal.[4] For Tossut, when scientists use information from other scientists in order to complete their research, they are all working together toward an epistemic goal of truth. This epistemic goal not only gives the scientists reasons to trust the work of the other scientists but also means that the knowledge that results can be considered social scientific knowledge. Unlike Longino, Tossut's theory says less about how scientific knowledge is created. Instead Tossut solely relies on how scientific knowledge is justified to argue that scientific knowledge is social. Tossut focuses on the fact that scientist rely on each other for information and therefore that the justification of the scientific knowledge created also involves this dependence on others. After having expained these two arguments for social scientific knowledge, I move on to a discussion of collective scientific knowledge in Chapter Two.

Chapter Two discusses different theories of collective knowledge and collective scientific knowledge. In the first section, I discuss Kristina Rolin's collective knowledge based on a joint commitment. Rolin's theory recognizes groups as "plural subjects".[5] For Rolin, using a joint commitment means that it is not necessary for all of the individuals within the collective to agree on one belief.[6] Instead the conditions for knowledge could be satisfied by various individuals within the collective, collectively or individually. However, it is only collectively that the knowledge conditions can be satisfied. Therefore, the subject of the knowledge must be the collective. In return for the justification being satisfied

4. Silvia Tossut, "Membership and Knowledge: Scientific Research as a Group Activity," *Episteme* 11, no. 3 (September 2014): 349–367.

5. Kristina Rolin, "Science as Collective Knowledge" [in en], *Cognitive Systems Research* 9, nos. 1-2 (March 2008): 116, `http://resolver.scholarsportal.info/resolve/13890417/v9i1-2/115%5C_sack`.

6. Ibid.

by those best able to provide it within the collective, the collective jointly commits to defending the knowledge as the knowledge of the collective.[7] In addition to explaining Rolin's claims for collective knowledge, I add my clarification regarding the burden of proof for the justification of the knowledge. I clarify that recognizing who has the burden of proof for the justification of the knowledge determines who the subject of the knowledge is. In the case of Rolin's jointly committed knowledge the burden of proof lies with the collective and not the individuals within the collective. Therefore, the subject of the knowledge is the collective and not the individual. This is why Rolin's collective knowledge based on a joint commitment is collective knowledge. By extension then if the knowledge held by this collective is scientific, there is a way to create collective scientific knowledge.[8]

In the second section of Chapter Two, I discuss an important distinction that Hyundeuk Cheon makes between irreducibly collective knowledge (ICK) and jointly committed knowledge (JCK). Cheon explains this distinction by comparing Rolin's jointly committed knowledge to K. Brad Wray's irreducibly collective knowledge. As previously discussed, Rolin's jointly committed knowledge depends on the fact that the collective jointly commits to defend the knowledge it puts forward as the knowledge of the collective. In contrast, Cheon explains that K. Brad Wray presents a view of irreducibly collective knowledge. For Wray, irreducibly collective knowledge is produced by groups with members that depend on each other in order to function.[9] According to Wray, this functional dependence is called

7. Rolin, "Science as Collective Knowledge," 120-121.

8. I have purposely left the word scientific here undefined. There is a vast amount of literature on the determination of scientific versus un- or non-scientific knowledge. This literature is usually found in considerations of what is known as the demarcation problem in scientific knowledge. For brevity, this thesis will not attempt to solve or describe this demarcation problem but instead will leave it up to the reader to debate what they consider to be scientific versus un- or non-scientific knowledge.

9. K. B. Wray, "Who has Scientific Knowledge?," doi: 10.1080/02691720701674288, *Social Epistemology*

"organic solidarity".[10] Cheon recognizes that both ICK and JCK justify their knowledge at the group level only.[11] It is only the collective that can justify the knowledge and this justification cannot be reduced to the individuals that make up the collective. According to Cheon, Rolin's JCK focuses on scientific beliefs and assumptions and explaining how they are used.[12] Wray's ICK, on the other hand, is focused on how collective knowledge is produced.[13] This distinction changes how criticisms should be addressed and the possibility that collective scientific knowledge could be created while still being known by an individual subject.

In the final section of Chapter Two, I discuss Jeroen de Ridder's version of irreducibly collective scientific knowledge. For de Ridder, knowledge is irreducible to one individual because each individual in the collective brings a necessary epistemic piece of the puzzle.[14] This may be because the individuals each bring some of the beliefs or evidence used by the collective to create the collective knowledge. It may also be that each individual provides part of the justification for the knowledge and therefore, the knowledge can only be attributed to the combined efforts of all of the individuals. In de Ridder's irreducibly collective scientific knowledge, the members of the collective depend on each other epistemically and practically.[15] De Ridder focuses on knowledge that requires a division of

21, no. 3 (July 2007): 342, http://dx.doi.org/10.1080/02691720701674288.

10. Wray, "Who has Scientific Knowledge?," 342.

11. Hyundeuk Cheon, "In What Sense is Scientific Knowledge Collective Knowledge?," doi: 10.1177/0048393113486523; 17, *Philosophy of the Social Sciences* 44, no. 4 (July 2014): 407–423, http://dx.doi.org/10.1177/0048393113486523.

12. Ibid., 414.

13. Ibid.

14. Jeroen de Ridder, "Epistemic Dependence and Collective Scientific Knowledge," *Synthese* 191, no. 1 (January 2014): 47.

15. Ibid., 46.

labour.[16] Issues like time constraints or level of detailed understanding may make it so that in order for some knowledge content to be produced, many individuals must combine their efforts and expertise. By focusing on what is necessary for justification of knowledge, de Ridder avoids some of the issues that Rolin and Cheon have to deal with when it comes to group belief. Arguing for or against group belief does not greatly impact the result of de Ridder's analysis.

No matter which version of collective knowledge has the most appeal, Chapter Two demonstrates that there are ways to characterize knowledge as more than individual knowledge. There can be collective scientific knowledge that differs from social scientific knowledge when it comes to the subject of knowledge or who/what provides the justification for the scientific knowledge. Another way to approach the difference between collective scientific knowledge and social scientific knowledge is to consider testimony related to that knowledge.

Chapter Three describes three approaches to testimonial justification. Theories on testimonial justification give the conditions under which a recipient or recipients are justified in acquiring knowledge from a testifier or testifiers.[17] These three approaches include the non-reductionist approach or non-reductionism, the reductionist approach or reductionism, and the dualist approach or dualism.

The non-reductionist approach argues that testimony can be a source of justified knowl-

16. de Ridder, "Epistemic Dependence," 46.

17. It should be noted that my use of recipient(s)/testifier(s) is akin to the traditional use of 'hearer(s)'/'speaker(s)' in much of the testimony literature. I prefer to use testifier and recipient as this opens the door to the possibility that the testifier is made up of a group of individuals or is the product of a group of individuals. Likewise the recipient of testimony could be a group of individuals or again a product.

edge as long as there are no defeaters present.[18] If the testifier is reliable, then the recipient can gain knowledge from that testifier provided the recipient has no defeating reasons or beliefs that contradict the knowledge from the recipient.[19] Non-reductionism focuses on the testifier and if the testifier is justified in sharing knowledge via testimony. Alternatively, the reductionist approach argues that testimony can be a source of justified knowledge as long as non-testimonial reasons can be given to support the testimony.[20] These non-testimonial reasons include "sense perception, memory, or inductive inference."[21] Reductionism comes in two forms, global reductionism and local reductionism. Global reductionism argues that all testimony in general is reliable if there are non-testimonial positive reasons that support this.[22] Thus, in global reductionism, the testimonial justification reduces to non-testimonial positive reasons for the reliability of the testimony. Alternatively, local reductionism does not consider the justification of testimony in general. Local reductionism focuses on the instances of testimony and if there are positive reasons for those instances.[23] Reductionism focuses on the recipient and if the recipient has positive reasons for justifying the testimony in question.

Jennifer Lackey argues that in focusing on either the testifier or the recipient only, non-reductionism and reductionism are not sufficient for testimonial justification.[24] Lackey

18. Jennifer Lackey, "Introduction," in *The Epistemology of Testimony*, ed. Jennifer Lackey and Ernest Sosa (Oxford University Press, 2006), 4.
19. Ibid.
20. Ibid., 5.
21. Ibid.
22. Jennifer Lackey, "It Takes Two to Tango: Beyond Reductionism and Non-Reductionism in the Epistemology of Testimony," in *The Epistemology of Testimony*, ed. Jennifer Lackey and Ernest Sosa (Oxford University Press, 2006), 161.
23. Ibid., 162.
24. Ibid., 170-171.

argues that elements from both non-reductionism and reductionism must be included in a theory of testimonial justification.[25] Lackey's dualism uses the reliability element from non-reductionism, the positive reasons element from reductionism and adds a focus on the testimony of content.[26] For Lackey, a recipient is justified in forming a belief when they base the belief on the content of the testimony, the testifier's testimony is reliable or truth-conducive, and the recipient has positive reasons for accepting the testifier's testimony.[27] In dualism, the focus is not solely on either the testifier nor the recipient. Both the testifier and recipient need to be considered in order for dualism to be satisfied, hence the name. Dualism makes the conditions for testimonial justification more rigorous and attempts to avoid concerns and criticisms that occur because non-reductionism and reductionism focus on only either the testifier or the recipient. When the reliability of the testifier is unknown, non-reductionism leaves no conditions outstanding that need to be satisfied in order to have testimonial justification. Dualism on the other hand still requires positive reasons and therefore, has some conditions even if the reliability or truth-conductivity condition is left unsatisfied. Reductionism has to deal with the criticism that all testimony at some point relies on testimonial reasons and cannot actually be reduced to only non-testimonial reasons. Dualism however, does not rest solely on this condition and therefore, can address this criticism.

A common theme that runs throughout the three kinds of testimony is a focus on individual testifiers and recipients. This focus on the individual may be a result of the commonly used language of speaker and hearer. I prefer to use testifier and recipient as

25. Lackey, "It Takes Two to Tango," 170-171.
26. Ibid., 170.
27. Ibid.

this opens the door to the possibility that the testifier is made up of a group of individuals or is the product of a group of individuals. Likewise the recipient of testimony could be a group of individuals or again a product. Another reason for the individualistic nature of testimony literature could be that the concept of group belief or collective knowledge and the subsequent testimony of it have not been a focus. However, discussion of these issues must coincide with the rise in scientific collaborations and arguments for the possibility of collective knowledge.

The final chapter goes through the different approaches to testimony and considers if each approach can be used to explain testimonial justification for collective scientific knowledge. When it comes to non-reductionism, the result is that there is no consideration of the interaction between the two kinds of testimony that occur in collective scientific knowledge. There can be consideration of the testimony of the individuals within the collective and the testimony of the collective itself but the question remains outstanding how one instance affects the other. Reductionism too becomes more complicated when considering collective scientific knowledge. Again it is the two kinds of testimony that become an issue. Global reductionism does not work because it would require that collective scientific knowledge be reducible to non-testimonial positive reasons. However, if the collective scientific knowledge is irreducible to an individual then it would be impossible for there to be only non-testimonial positive reasons. Therefore, in the second section, I focus on a discussion of Deborah Tollefsen's argument for group testimony based on a form of local reductionism. However, this theory again focuses only on the testimony of the collective and says nothing about the impact of the testimony found within the collective. The last section of Chapter Four considers the possibility of a dualist approach to testimony of

collective scientific knowledge. I find that dualism can be consistent with the testimony of collective scientific knowledge at the collective level. I also find that dualism is compatible with the testimony of the individuals within the collective. However, there again is not consideration of how the testimony of the individuals within the collective impacts the ability of the collective to satisfy the conditions of dualism.

Chapter 1

The Need for Social Scientific Knowledge

In order to provide a basis for understanding why a theory of social scientific knowledge is necessary this chapter begins with a discussion of Helen Longino's concerns with two individualist theories of scientific knowledge, logical positivism and wholism[1]. According to Helen Longino, the logical positivists believe that "knowledge is that whose content is true and experienced or derived from known experiential (observational or basic) statements in a rule-governed way."[2] Observational or basic statements are statements that derive from observations made by the senses. These observational statements are then connected to each other in a logical or rule-governed fashion that is meant to provide support for a hypothesis and/or theory. This according to Longino is not a satisfactory explanation of the production of scientific knowledge. For Longino, logical positivism does not accurately characterize the relations between evidence and hypothesis or theory because it is restricted

1. I am using Longino's spelling of 'wholism' here, rather than 'holism', in order to be consistent with the work I am referencing.

2. Helen E. Longino, *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry* (Princeton University Press, 1990), 22.

to the use of observable data and unrelated theoretical statements.[3] Therefore, logical positivism cannot adequately explain why certain observable data is selected for use in supporting a hypotheses while other data is not.

Wholism argues that observational or basic statements are not produced independently of the theory or hypothesis for which these statements are said to provide support. As Longino states, "confirming or disconfirming observations, on this view, cannot be specified independently of a theory but are themselves given content, at least in part, by theory and described in language whose meaning [is] dependent on the whole of a theory."[4] This theory-ladeness of the observational or basic statements results in the problem of incommensurability, which Longino argues is inconsistent with current scientific practice. In wholism, different hypotheses cannot be compared despite being supported by the same set of data. Further, wholism requires that the entire theory be amended if the data changes in some way which Longino argues does not accurately describe how science proceeds.[5]

For Longino, the missing element in these two theories is the social aspect of scientific knowledge. By taking a closer look at evidence and evidential relations, Longino was able to identify background assumptions that account for the connections between data, hypothesis, and theory. Longino then came up with a theory of science as social knowledge that is referred to as critical contextual empiricism. In critical contextual empiricism, background assumptions play an important role in determining what data is considered relevant. These background assumptions come in the form of critical contextual values or social influences. It is through the use of these background assumptions that Longino

3. Longino, *Science as Social Knowledge*, 22-25.
4. Ibid., 27.
5. Ibid.

is better able to address the difficulties facing logical positivism and wholism. Further, critical contextual empiricism takes into account the social nature of and interactions that occur in science while still relying on the empirical nature of science for its justification.

The final section of this chapter presents a slightly different view on the social nature of scientific knowledge. In order to argue that science is social knowledge Silvia Tossut focuses on the social influences that affect the complex justification of scientific knowledge. For Tossut, the justification of scientific knowledge includes relying on the knowledge of others and it is this reliance on others that makes scientific knowledge social.

1.1 A Brief Critique of Logical Positivism

Helen Longino critiques logical positivism for not providing a satisfactory account of why evidence confirms or supports a hypothesis in question.[6] More specifically, there is a disconnect between the evidence used and the rule-governed reasoning for why this evidence confirms the hypothesis.[7] To explain this criticism, Longino uses Carl G. Hempel's arguments from "Studies in the Logic of Confirmation"[8] as an example of logical positivism.

In Hempel's view, the goal is to provide an account of when observation statements confirm, disconfirm, or are neutral with respect to hypothesis statements.[9] In creating this account, Hempel is trying to provide the "purely formal criteria of confirmation in a manner similar to that in which deductive logic provides purely formal criteria for the

6. Longino, *Science as Social Knowledge*, 22-25.

7. Ibid., 24-25.

8. Carl G. Hempel, "Studies in the Logic of Confirmation," in *Aspects of Scientific Explanation* (The Free Press, 1965) quoted in Longino, *Science as Social Knowledge*, 22-25.

9. Carl G. Hempel, "I.-Studies in the Logic of Confirmation (I.)" [in en], *Mind* LIV, no. 213 (January 1945): 3, `http://resolver.scholarsportal.info/resolve/00264423/vlivi213/1%5C_iitloc`.

validity of deductive inferences."[10] In order to create a theory of confirmation, Hempel focuses on a form of reconstruction rather than induction. An analysis of whether the evidence, ie. observation reports, confirms, disconfirms, or is neutral with respect to the hypothesis can only be performed once there is a hypothesis and observation reports.[11] For Hempel, once there is a hypothesis and once some data has been collected and turned into observation statements, a reconstruction of the connection between the hypothesis and observation reports can be created. This reconstruction will then determine in a purely formal way if the observation reports confirm, disconfirm or are neutral with respect to the hypothesis.[12][13]

The purely formal connection between observation statements and hypothesis means that "what would count as evidence for a hypothesis is determined by the form of hypothesis or theory statements and evidence sentences, not by their content."[14] It is not the observations that provide the actual evidence for the hypotheses and theories, it is instead an assessment of the logical connection between hypothesis or theory statements and evidence statements. For Longino, logical positivism is inconsistent with current notions of scientific knowledge because for current notions content provides the direct evidence for the hypothesis statement. So, Longino concludes that the logical positivist version of scientific knowledge formation is inadequate because it does not explain how science creates or confirms hypotheses based on the observations made in the experiments but instead

10. Carl G. Hempel, "I.-Studies in the Logic of Confirmation (II.)" [in en], *Mind* LIV, no. 214 (April 1945): 9, `http://resolver.scholarsportal.info/resolve/00264423/vlivi214/97%5C_iitloc`.
11. Ibid., 114.
12. Hempel, "I.-Studies in the Logic of Confirmation (I.)."
13. Hempel, "I.-Studies in the Logic of Confirmation (II.)."
14. Longino, *Science as Social Knowledge*, 48.

relies on a logical connection between hypotheses and observation statements.

Given these arguments, Longino does not feel that logical positivism accurately characterizes the nature of scientific knowledge. The alternative theory of wholism was purposed to help address the issue of connection between data and hypothesis and/or theory and to account for some of the major theory shifts found in a historical review of science. However, as we shall see in the next section, Longino is not convinced by the wholist argument either.

1.2 A Brief Critique of Wholism

As an alternative to logical positivism and after consideration of the historical aspects of scientific knowledge, wholist theories[15] were proposed by philosophers of science such as "Norwood Russell Hanson, Thomas Kuhn, and Paul Feyerabend"[16] These wholist theories introduced the notion of theory-ladenness where meaning or observation is influenced by the theory it is related to. Some theories like those of Paul Feyerabend focus on meaning being theory-laden where "the meanings of the terms occurring in a theory are determined by the theory, with the consequence that the same word used in different theories has different meanings."[17] Other theories like those of Norwood Russell Hanson and Thomas Kuhn, focus on observation being theory-laden meaning that "one sees and experiences

15. Here I am reiterating Helen Longino's excellent discussion of Wholism in her book Longino, *Science as Social Knowledge*. In this work Longino is referencing the following works: "Explanation, Reduction, and Empiricism" and "Against Method" by Paul Feyerabend, *Patterns of Discovery* by Norwood Russell Hanson, and *The Structure of Scientific Revolutions, 2nd Ed.*, "Refletions on my Critics," and "Theory Change as Structure Change" by Thomas Kuhn.

16. Ibid., 25-26.

17. Ibid., 26-27.

the world in a way prescribed by one's theory (or theories)."[18] This explains how the same data can be used to support different theories.[19] Theory-ladenness also explains how large-scale shifts in frameworks or paradigms happen in science despite the same data being used.[20] For example, the same observations were used to support both the Ptolemaic and Copernican theories on how celestial bodies move but the observations had different meanings and consequences for each theory. This explains how there could be a shift from the Ptolemaic theory to the Copernican theory as the explanation for the movement of celestial bodies even though much of the data and observations hadn't changed. With the addition of new data and a new theory the observations made to support the Ptolemaic theory could also be used to support the Copernican theory.[21]

However, wholism does not satisfy Longino as a useful theory of scientific knowledge. This is because wholism has difficulties explaining changes within a theory. Wholism accounts for theory changes in science by arguing that the meanings behind the data change as the theory changes. Even though two theories may use the same term to refer to data, each theory is in fact referring to different data. Because wholism restricts itself to considering theories on the whole there is no way to account for the changes in one part of the theory without creating a completely new theory.[22] With the introduction of new data, there must be a corresponding change in the theory as a whole. Data cannot be added or subtracted in order to add support for or falsify a theory. Instead, the addition

18. Longino, *Science as Social Knowledge*, 26-27.
19. Ibid., 26.
20. Ibid.
21. Ibid.
22. Ibid., 27.

or subtraction of data creates a completely new theory.[23] Longino argues this is not how science works because science appears to be able to change the relations between data and hypothesis or theory without necessarily changing all meanings within the theory or creating a new theory.[24] Instead, science appears to build and amend previous theories in response to the introduction of new observational data. Sometimes, completely new theories are created but this is not always the case. Further, new theory creation usually includes consideration of previous data relations to the old theory.

A further problem for wholism is incommensurability; that is wholism cannot provide a way for theories to be compared to one another.[25] In wholism the usefulness and meaning given to data is theory specific. The theory-ladenness of data means that comparison between two hypotheses or theories becomes impossible because the theories are basically written in different languages that cannot be translated into one language and then compared.[26] As Longino points out, "there is no neutral or independent set of data that can serve as arbiter between the theories."[27] Thus, in looking at evidential relations, once again, wholism does not seem to accurately capture the nature of science nor the relations between scientific theory and evidence.

1.3 Helen Longino on Science as Social Knowledge

Having discussed these issues with individualist theories of scientific knowledge, I will now move on to discussing how Helen Longino views evidential relations in scientific knowledge.

23. Longino, *Science as Social Knowledge*, 27.
24. Ibid.
25. Ibid.
26. Ibid.
27. Ibid.

When it comes to evidential relations, Helen Longino argues that what connects data to a hypothesis or theory is background assumptions that surround the scientific knowledge in question. As Longino states background assumptions are "other beliefs [a] person has concerning the evidential connection."[28] These other beliefs are about the regularities that connect data to a hypothesis or theory.[29] For example, because of a person's beliefs surrounding red itchy spots on a child's stomach and measles, that person will likely take seeing red itchy spots on a child's stomach as evidence that the child has measles.[30] Another example would be a person's beliefs about mercury, a thermometer, and temperature will likely result in that person believing that mercury rising in a thermometer is evidence for an increase in temperature.

The use of background assumptions is helpful in dispelling the previously discussed concerns with logical positivism and wholism. Unlike logical positivism, Longino is able to explain how data becomes evidence for a hypothesis or theory without relying on rational reconstruction or being limited to observable data. Instead of reducing the connection between data and a hypothesis or theory to an argument on the logical acceptability of the connection, background assumptions allow observation statements to provide direct support for hypothesis or theory statements. Using the mercury example, logical positivists would have the data in the form of observation statements relating to mercury levels in the thermometer; temperature increases; and then statements about the connection between the two previous statements. However, there is a problem of inference. No matter how many instances occur in which there is a correlation between the mercury rising and the

28. Longino, *Science as Social Knowledge*, 41.
29. Ibid.
30. Ibid.

temperature increasing there is no way to observe the causation involved. All that can be observed are effects; there is no way to observe how the increase in temperature makes the mercury rise or how the mercury rising increases the temperature. The only way to make the connection is to make an inferential jump from the data to the hypothesis or theory or to include within the data statements an assumption that links the data to the hypothesis or theory. This assumption means that the data cannot be independent as is argued by the logical positivists. However, if Longino is correct then the data can remain independent while the background assumptions dictate what meaning and connection the data has to the hypothesis or theory. Therefore, Longino's use of background assumptions is more beneficial than logical positivism in explaining the evidential relations in scientific knowledge.

Unlike the wholists, Longino does not have to deal with the problem of incommensurability. Data can have the same meaning for different theories. What changes is the background assumptions surrounding how that meaning affects the hypothesis or theory. To use the mercury example, it is not that "mercury rising" has a different meaning to a theory about temperature as opposed to a theory about pressure. It is that for one theory the background assumptions that connect mercury rising to something, connect mercury to temperature whereas for a different theory, mercury rising is connected to pressure. In this example, Longino can say that both scientists are not necessarily working on different theories. As it turns out both of these theories are parts of the same theory, The Ideal Gas Law. For Longino this also explains how progress on scientific theories is made without the need for complete theory revision. New data can be used with reference to the same old theories and the use of background assumptions will dictate how this new

data will work within the theory. Of course, background assumptions explaining evidential relations does not discount the possibility or need for revolutions or complete revision of theories in science but it does explain adjustments that are made to current theories. Thus, Longino argues that it is best to consider background assumptions as the key to explaining evidential relations rather than logical positivism or wholism.

Background assumptions may account for evidential relations but where do these background assumptions come from? Longino suggests background assumptions come from the social nature of science and scientific knowledge. That is science is social because it is a practice or activity done "not primarily by individuals but by social groups."[31] Longino follows Marjorie Grene in arguing that science is social because one scientist relies on others in at least three ways. First, scientists rely on others for "conditions (ideas, instruments, et cetera) under which they practice."[32] Second, scientists rely on education by others to introduce them to their scientific field of study.[33] Third, since science is an activity done within a society, science relies on "society's valuing what they do."[34] It seems plausible then that scientific knowledge, being the product of science, is also social. If the knowledge production process is social then the knowledge produced can also reasonably be classified as social. Since the background assumptions are the evidential relations in a social process, are the background assumptions also social? For Longino, they can be social and are most likely the result of social factors surrounding science. For example, what may make one scientist use a background assumption about mercury and temperature over mercury and

31. Longino, *Science as Social Knowledge*, 67.
32. Ibid.
33. Ibid.
34. Ibid.

pressure could be the teacher they had or the need in society for a way to measure temperature rather than pressure. Thus, Longino argues that social influences like conditions, education, and society help dictate the background assumptions that explain the evidential relations in scientific knowledge. Now, that we understand how Longino views evidential relations, I will move on to Longino's view on the creation of social scientific knowledge.

1.4 Helen Longino's Critical Contextual Empiricism

In addressing the various ways in which social factors affect the knowledge production process, social scientific knowledge makes it possible for the knowledge production process to benefit from the interaction of multiple perspectives working in conjunction with one another. Social scientific knowledge allows consideration of the interaction between scientists and a way to understand collaboration among scientists not just as a division of labour but as a source of knowledge. In critical contextual empiricism, Helen Longino stipulates a set of guidelines for the production of social scientific knowledge.

For Helen Longino,

> some content A is *epistemically acceptable* in community C at time t if A is or is supported by data d evident to C at t in light of reasoning and background assumptions which have survived critical scrutiny from as many perspectives as are available to C at t and C is characterized by venues for criticism, uptake of criticism, public standards, and tempered equality of intellectual authority.[35]

This definition contains four criteria that communities must meet that I will now expand

35. Longino, *The Fate of Knowledge*, 135.

a bit more on.

The community must have venues within which criticism of the knowledge content and knowledge production process can be evaluated. Further, these venues must be public so that they too can be subject to criticism.[36] Current examples of venues include some peer reviewed journals and conferences. However, with the changing nature of technology and society what is considered an acceptable public venue may change to consider online sources. What is important is that these venues provide a place or forum within which criticism and discussion can take place. Thus, it is possible that some online discussion boards, informational websites, webinars, and maybe even YouTube channels and/or video feeds could be considered acceptable public venues.

The community must be allowed to and encouraged to change in accordance with the criticism.[37] Criticism should not only be taken up by the community but those who present the criticism in response to replies from the community.[38] The back and forth nature of critical uptake allows Longino to regulate against inclusion of criticism that has been presented multiple times before. For example, if the accuracy of carbon dating of fossils is challenged, taken up, and then amended in response to criticism of carbon dating, it is no longer acceptable to continue to challenge the accuracy of carbon dating without presenting further reasoning as to why this criticism should be made again.

The public standards for a social knowledge producing community is determined by the community but must be publicly recognized as the standards that community upholds.[39]

36. Longino, *The Fate of Knowledge*, 129.
37. Ibid.
38. Ibid.
39. Ibid., 130.

These standards are used to evaluate content and practices, determine what criticism is acceptable, and on some level dictate the goals of the community.[40] For example, if the goal of the community is a mechanistic explanation rather than say a causal explanation then the standards for what is considered acceptable practices and content will differ. Returning to our mercury and temperature example, a mechanistic explanation is different from the theoretical causal explanation associated with the rise in mercury level and the increase in temperature. A mechanistic explanation would likely include a detailed listing of the conditions under which the mercury rises and then how the levels are read by an observer in order to determine temperature. A causal explanation on the other hand, would likely need to explain and justify the conclusions made in the Ideal Gas Law using theoretical physics and chemistry.

Finally, Longino's criteria for equality of intellectual authority is a way to ensure that while as many perspectives as possible are considered, a certain epistemic condition not just a social or political condition must be met. This condition is complex because it is not and likely never will be easy to separate levels of epistemic authority from social and political authority. Nevertheless, there is some clarification that can be made. For Longino, this requirement is tied to the idea of legitimacy and the goal of producing knowledge that is as free from bias as possible.[41] The idea of legitimacy recognizes that content should be as thoroughly criticized as possible.[42] So, if we want to ensure that our content or knowledge is legitimate, we must ensure that as many reasonable criticisms as possible are considered. Thus, the intellectual authority of the person should be such that they have the intellectual

40. Longino, *The Fate of Knowledge*, 130.
41. Ibid., 131-132.
42. Ibid., 132.

resources to provide criticism in accordance with the other conditions. This criterion is tied to freedom from bias because intellectual authority should not be based on political or social authority. Longino recognizes that consensus on the legitimacy of content could be the result of political or social pressure put on the other members. It is also possible that the political or social authority of some members could result in their opinion having more weight in a discussion and/or influencing the consensus of the community unfairly. Therefore, Longino uses this criterion to ensure that those who are of equal intellectual authority are included regardless of their political or social status. Finally, Longino states that the community should encourage and foster the development of new perspectives that could provide criticism.[43]

Longino recognizes that the above definition of epistemically acceptable content can be seen as ideal conditions for the creation of social knowledge and social scientific knowledge. A community that meets the ideal conditions for characterization, will ideally produce social knowledge. A scientific community that meets the ideal conditions will ideally produce social scientific knowledge.[44] Because of the ideal nature of the conditions, communities can only be more or less capable of satisfying the conditions. Therefore, it is best to discuss communities as being more or less good at creating social knowledge or social scientific knowledge. The closer a community is to being characterized by the ideal conditions, the better it will be at creating social knowledge or social scientific knowledge. For example,

43. Longino, *The Fate of Knowledge*, 132.

44. I want to recognize that there is an issue of demarcation here in terms of how to differentiate between social knowledge and social scientific knowledge. For our purposes, I will consider a social scientific knowledge community a community that agrees to adhere to the methods for creation of data set out in the scientific community's public standards. This is by no means an agreed upon definition but it will suffice for my purposes.

a community that only has 2 members with similar perspectives will be less capable or good at producing social knowledge than a community of say 100 members with various perspectives.

Longino acknowledges the common challenge brought up by critics that critical contextual empiricism is subject to what I call global bias. This means that any bias or "assumptions that are shared by all members of a community will not only be shielded from criticism, but, because they persist in the face of effective structures, may even be reinforced."[45] For example, if the entire community assumes that women are less intelligent then men, then this assumption may result in women being excluded from the sample of subjects. In this instance, no data or evidence will be presented to critique the notion that women are less intelligent as men because no data will be provided on women let along women who are equally or more intelligent then men. In response, Longino suggests that communities should be open to discussions with other communities.[46] This may help to foster criticism that was not previously considered. Further, Longino provides a reminder that these criteria are fluid and subject to criticism themselves.[47] It is possible that what is considered acceptable according to the criteria today will not be acceptable according to criteria in a few days or in 10 years.

Helen Longino's conception of social knowledge is helpful as a starting point for considering how a community of individuals can create knowledge. Critical contextual empiricism gives an example of a process for creating knowledge that not only acknowledges the influence of social factors but also encourages their use in order to limit bias and foster criticism.

45. Longino, *The Fate of Knowledge*, 135.
46. Ibid.
47. Ibid., 134-135.

However, Longino's approach is not the only way to view knowledge as social knowledge or social scientific knowledge. I turn now to another theory of social scientific knowledge by Silvia Tossut.

1.5 Silvia Tossut's Social Scientific Knowledge

Silvia Tossut also presents an argument for scientific knowledge as social knowledge. For Tossut scientific knowledge is social because of the complex justification needed for scientific knowledge claims.[48] In order for this complex justification to be completely satisfied, members of the justifying collective need to rely on the knowledge of others. For Tossut, it is the truth-oriented epistemic goal of a collective of scientists that explains why collective scientific activities can not only be trusted but be considered social knowledge.[49]

According to Tossut, being a member of a specific scientific community that shares an intention toward the particular epistemic goal of truth gives the members special licence or entitlement to trust the work and knowledge from other members of the scientific community.[50] Be it a scientific collaboration, a scientific team, or a larger scientific community like a discipline or sub-discipline, membership within these groups comes with a particular set of common knowledge claims that include shared intentions. Using M.E. Bratman's idea of shared intentionality, Tossut explains that scientific communities carry a "commitment not to lie" in a broad sense.[51] Because the scientific community, be it a collaboration or larger discipline, has the shared intention of a truth-oriented epistemic goal, those within

48. Tossut, "Membership and Knowledge," 349.
49. Ibid., 351.
50. Ibid., 353.
51. Ibid., 357.

the community commit to the truth of their own knowledge thus advancing the community's overall goal of epistemic truth. Members assist others in attaining epistemic truth by providing true scientific knowledge that others within the group can use and feel entitled to use as justified scientific knowledge. So, according to Tossut, members in a scientific community have a good and strong reason to accept the testimony of other members within the community.

Further trust in the other members of a scientific community can occur despite the knowledge that some individuals will belong to a scientific community for reasons other than truth. In fact, Tossut admits that many individuals will have sub plans that are different than the community's truth-oriented goal.[52] These sub plans are acceptable as long as they "mesh" with the community's overall truth-oriented goal.[53] Tossut follows Bratman in arguing that members do not have to have sub plans that are consistent with the community's common goal nor do these sub plans need to be related to truth.[54] A member may choose to be part of a scientific community while being indifferent to the goal of truth for other reasons. For Tossut, this is acceptable as long as these reasons or sub plans do not conflict with the scientific community's goal of truth.

The meshing sub plans also explain how competing research teams or members of scientific sub-disciplines can rely on others within the field.[55] The degree to which sub plans mesh indicates the level of cooperation and therefore trust that can be given to scientific knowledge produced by the group in question.[56] Because competing research teams have

52. Tossut, "Membership and Knowledge," 355.
53. Ibid.
54. Ibid., 358.
55. Ibid., 360.
56. Ibid., 363.

meshing sub plans related to proper scientific procedure and reporting of results along with the overall goal of achieving truth, teams are entitled to trust other teams with the same sub plans and epistemic goals. Thus, while they may not be cooperating with respect to use of the same theory or hypotheses, they are cooperating when it comes to their standards of scientific practice and truth-orientation. The cooperation element of these scientific endeavours means that the knowledge produced can be properly classified as social knowledge.[57]

In discussing social knowledge, Tossut also considers how scientific knowledge is taken up by non-scientists. Again the truth-oriented epistemic goal of the scientific community provides the justification for accepting the knowledge presented by scientific collaborations and the sciences in general.[58] By recognizing that there is a shared goal oriented to truth in the sciences and that science has come up with the best way to achieve this goal, non-scientists are justified in accepting a simplified version of the scientific knowledge that the scientific community provides.[59] The epistemic truth-oriented goal is what allows non-scientists to trust those in the scientific community.

Much of Tossut's theory relies heavily on the shared intentions of the members of the scientific community and that the common goal is enough to convince members to uphold a commitment not to lie. I am particularly concerned that internal regulation may not be enough to ensure that the scientific community as a whole commits to truth. It may be necessary to have an external source who's job it is to ensure that social scientific knowledge communities uphold this commitment not to lie. Alternatively, there may need to be a

57. Tossut, "Membership and Knowledge."
58. Ibid., 364.
59. Ibid.

way that social scientific knowledge communities can evaluate and display their adherence to the truth-oriented goal and commitment not to lie.

For my thesis, Tossut's argument does not go far enough. Tossut has presented an argument for social scientific knowledge but not for collective scientific knowledge. Tossut specifically remains committed to a theory that is individualistic but contains necessary social elements.[60] My focus is on collective knowledge where the subject of knowledge is the collective and not a particular individual within the collective. In the next chapter, I discuss theories on collective knowledge where the subject of knowledge is the collective and not an individual.

60. Tossut, "Membership and Knowledge," 360.

Chapter 2

Collective Scientific Knowledge

In this chapter I present different arguments for collective knowledge and therefore, collective scientific knowledge. Unlike the previously discussed social scientific knowledge theories, collective knowledge theories acknowledge a plural subject knowledge. Collective knowledge is concerned with how and why collections of individuals create knowledge. In collective knowledge situations, knowledge is only possible though the actions of more than one individual. How these actions combine to create collective knowledge can vary. This chapter presents three different perspectives on collective knowledge and collective scientific knowledge.

The first section discusses Kristina Rolin's argument for collective knowledge based on a group joint commitment. Rolin argues that the collective can hold a belief and all the individuals jointly commit to promoting that belief as the belief of the collective. In the next section, I discuss Hyundeuk Cheon's distinction between two forms of collective knowledge based on multiple subjects designated jointly committed knowledge (JCK) and irreducibly collective knowledge (ICK). Cheon argues that jointly committed knowledge

(JCK), like that proposed by Rolin, is only one version of collective knowledge. Cheon takes arguments from K. Brad Wray in order to explain irreducibly collective knowledge where, unlike in JCK, the collective is epistemically dependent on the individuals within the collective, making the knowledge irreducible to any individual within the collective. In the final section, I demonstrate how Jeroen de Ridder argues for an irreducibly collective knowledge that, unlike Cheon, focuses on the basis for the justification of the knowledge rather than belief. Because of a slightly different focus, de Ridder's irreducibly collective knowledge seems to be the most convincing and least susceptible to criticism out of all of the arguments for collective scientific knowledge.

2.1 Kristina Rolin's Joint Commitment

Kristina Rolin's version of social knowledge extends knowledge beyond the individual to a group or collective subject of knowledge. This takes the social aspects of knowledge beyond just looking at social interactions among individuals. Rolin focuses on "what extent scientific knowledge is held by groups of scientists as *plural subjects*."[1] For Rolin, it is not good enough to claim that a group of scientists involved in a collective scientific project each individually hold the knowledge produced by the collective.[2] It is not the sum of the individual knowledge that is the knowledge produced. In a collective scientific project, it is knowledge that the collective puts forward as a collective that is produced and this knowledge cannot be reduced to individual knowledge.[3] Rolin uses joint commitment to explain how a collective produces knowledge.

1. Original italics. Rolin, "Science as Collective Knowledge," 116.
2. Ibid.
3. Ibid.

A joint commitment is not just a belief held by all individuals. In fact, not all or even most of the individuals in the collective need to accept the belief in order to jointly commit to promoting the belief as the belief of the collective. The collective can put forward a consistent statement of the collective's beliefs without requiring the individuals that are part of the collective to also meet the full criteria for holding this belief. For example, there could be a collective belief, b, that when mercury rises in the thermometer, the temperature is increasing. Scientist one, S_1, may have the belief, bs_1, that the temperature increases which increases the pressure which causes the mercury to rise. Scientist two, S_2, may have the belief, bs_2, that when the mercury rises in the thermometer, the temperature is increasing. Scientist three, S_3, may have the belief, bs_3, that the movement of the molecules in the mercury increases as the temperature increases. The increased movement of the molecules increases the pressure of the mercury which causes the mercury to rise in the thermometer. All three scientists may agree that collectively the belief they want to promote is belief, b, that when the mercury in the thermometer rises the temperature is increasing. If someone asks any one of the scientists what the collective group of scientists believe, they will say that they believe b because that is the belief they all jointly committed to even though only one of the scientists believes the same as the collective. Specifically, only bs_2 is exactly the same belief as b; bs_1 and bs_3 would be considered different beliefs because of the details involved.

The benefit to allowing collective belief is that, if we are using a justified true belief or acceptance[4] model of knowledge, the criteria of justification, truth, and belief, do not need

4. Here acceptance is taken as a proposition of sorts. I am using L. Jonathan Cohen's definition of knowledge from K. B. Wray, "Who has Scientific Knowledge?," doi: 10.1080/02691720701674288, *Social Epistemology* 21, no. 3 (July 2007): 337–347, `http://dx.doi.org/10.1080/02691720701674288`.

to be satisfied by each and every individual within the collective. In collective belief, it is the collective as a whole that holds the belief and the collective as a whole that delegates the role of providing justification to those who are the best at providing the necessary information. Further, because it is not required that all the individuals in the collective hold the belief it is understandable how scientists can and often do use falsification in order to provide evidence for a theory. If a scientist does not hold the belief of the collective, they can choose to attempt to amend it or falsify it by using the collective's belief as what Rolin calls a "default entitlement".[5]

A default entitlement is a proposition that can be assumed to be held and used until it is shown that the collective no longer holds that belief.[6] Rolin argues that background assumptions "function as default entitlements."[7] Thinking about background assumptions as default entitlements gives guidance on what kind of beliefs Rolin wants to classify as default entitlements. Rolin makes this claim in order to "[give] an account of the epistemic status of background assumptions in scientific reasoning."[8] Rolin uses the benefits of Longino's social scientific knowledge when discussing the production of collective knowledge. By using background assumptions as default entitlements, Rolin can connect data to a hypothesis or theory and amend only parts of a hypothesis or theory. For example, our collective of scientists before included S_1, S_2, and S_3 who all jointly committed to believing belief b. This joint commitment gives the collective a default entitlement to the belief b. Therefore, the collective has a background assumption, b, that as the mercury rises in the

5. Rolin, "Science as Collective Knowledge," 119-120.
6. Ibid.
7. Ibid., 119.
8. Ibid.

thermometer, the temperature is increasing. The collective can then use this assumption during other tests on say, how fast temperature rises in different situations.

Understanding background assumptions as default entitlements also explains how different collectives can disagree with each other. For example, it could be the case that one collective holds the belief b as stated above while another collective has the belief, p, that as the mercury rises in the thermometer, the pressure is increasing. In this case, we have two collectives that observe and use the same data. However, because each collective acts on different default entitlements, the collectives will disagree on the meaning of the data. Both collectives may agree that as the mercury rises it signifies a measurement in the form of increasing numbers. As the mercury lowers the numbers decrease resulting in more measurements. For both collectives the same data set is created from the numbers the mercury is at at different times and situations. For the collective with the default entitlement b, the increasing numbers represent an increase in temperature. For the collective with default entitlement p, the increasing numbers represent an increase in pressure. To summarize, the discussion so far has explained Rolin's argument for background assumptions as default entitlements that a collective is allowed to use because they are part of the collective. The rest of this section discusses an obligation with respect to default entitlements elicited by membership within the collective and how this obligation makes Rolin's theory a theory of collective knowledge.

For Rolin a collective has "a joint commitment to defend default entitlements in case they are challenged in an appropriate way."[9] If the default entitlement b is challenged by the collective that believe in p, then it is the responsibility of the collective as a whole to

9. Rolin, "Science as Collective Knowledge," 121.

justify the belief b. Here is where Rolin's theory becomes a theory on collective knowledge. Rolin's theory of joint commitment is a theory of collective knowledge because it is the collective and not an individual that is in a position to defend the default entitlements of the collective.

When determining who is required to defend default entitlements, it is important that the subject of knowledge be determined. This subject can be an individual in the collective or the collective as a whole. If it is the role of the collective as a whole to defend the default entitlement or collective belief then for Rolin the belief is part of the collective knowledge of the group and not the knowledge held by the individual participants of the collective.[10] The burden of proof for the justification of the collective knowledge in this case is the responsibility of the collective as a whole rather than any one of the collective's parts.[11] But what does burden of proof have to do with determining knowledge? I suggest that the burden of proof determines what kind of justification is necessary in order to have a justified true belief or acceptance. Determining who holds the burden of proof sheds light on who the subject of knowledge is. The subject responsible for holding the knowledge is responsible for being able to explain the justification for the knowledge in question. If the justification cannot be reduced to an individual but rather requires the input of multiple parts of the collective, then it seems reasonable to conclude that no individual is responsible for providing the justification. Rather, it is the responsibility of the collective as a whole to combine the pieces of justification provided by each individual. Thus, I argue that Rolin's theory is a theory of collective knowledge because the theory includes an obligation by

10. Rolin, "Science as Collective Knowledge," 122.
11. Ibid.

the collective to defend its default entitlements and this defence is only possible by the collective and not one individual within the collective.

2.2 Hyundeuk Cheon's Irreducibly Collective Knowledge vs Jointly Committed Knowledge

Hyundeuk Cheon provides an explanation of two different types of collective knowledge: irreducibly collective knowledge (ICK) and jointly committed knowledge (JCK). Cheon uses theories from K. Brad Wray to explain irreducibly collective knowledge as knowledge that is accepted by a group and not reducible to the individual member's views.[12] According to Wray, it is only groups that show organic solidarity that can have collective knowledge.[13] When a group shows organic solidarity, the group members "depend upon the proper functioning of the other members."[14] In other words, the members of the group depend on each other for justified knowledge that they require in order to complete their portion of the knowledge production process. Thus, it is only together that the group or collective can produced knowledge. For example, when the research group mapped the human genome, many different individuals worked together and depended on the expertise of others.[15] For instance, it is likely that the geneticists had to depend on technicians that worked the equipment. Without both the geneticists and technicians performing their part of the process the sequencing would not have been completed as quickly, if ever. There would

12. Cheon, "In What Sense," 412.
13. Wray, "Who has Scientific Knowledge?," 342.
14. Ibid.
15. National Human Genome Research Institute, "An Overview of the Human Genome Project: What was the Human Genome Project?," National Human Genome Research Institute, `https://www.genome.gov/12011238/an-overview-of-the-human-genome-project/`.

likely be too much information for one person to learn in one lifetime particularly to the level of expertise expected of a scientist or technician. Further, a full explanation of all the evidence and links used in the justification of the knowledge produced may be too complex for one person to explain. There would need to be justification for among other things the tests done, the conclusions made, and even why the equipment used was appropriate. In a project like the Human Genome Project, explaining all of the evidence for each research centre and why each research centre was justified in the knowledge they created may be too much for one person to explain and understand on their own. For example, being able to understand all of the technical aspects of the machines used and why their use is justified along with understanding all of the background genetic theory is a lot for someone to potentially know. Further, that person is only likely to know the explanation for one centre and not all of the centres working on the project. At some point, it is likely that a person has to defer to someone else for verification that a different centre adhered to the required process. So, with irreducibly collective knowledge it is not just about individuals working together nor is it just about social influences that impact the creation of knowledge. In irreducibly collective knowledge (ICK), the individuals in the collective depend on each other functionally, that is they depend on each other in order to complete the knowledge production process.

Cheon's jointly committed knowledge (JCK) is based on Rolin's view of collective knowledge. There are two elements to Cheon's definition of JCK. First, there is a joint commitment by the members "to *believe* or *accept* as a body certain propositions."[16] Second, it is required "that group members have a motivation to participate in such a commit-

16. Cheon, "In What Sense," 413.

ment."[17] In JCK it is only that a group agrees to put forward a view as the view of the group and not necessarily that the knowledge is produced by the interdependence of the group's members. The group could accept or take on the view of one of the members who is individually justified in believing the knowledge. Alternatively, the group could commit to a belief that none of the members hold. As pointed out by Rolin, what is important in jointly committed knowledge is that the members of the group are entitled to hold the view and commit to defend the view as the view of the group if it is challenged.

Cheon notes that these two characterizations of collective knowledge are similar in that they are not dependent on a summative approach to knowledge.[18] In the summative approach, the view of the group can be characterized as the sum of the views of all or most members of the group. This means that individually most or all of the members of the group are justified in believing the view that the group then all so believes. However, neither ICK nor JCK requires that a majority of the individuals in the group believe or accept the view of the group. The individuals in the group can agree, disagree, or be neutral with respect to their personal belief on the view presented. It is also not important if most or all of the individuals in the group are justified in believing the view of the group. What is important for both ICK and JCK is that the group as a whole is presenting the information as the group's view and the group as a whole is justified in its belief or acceptance of the view.

Cheon argues that ICK and JCK have different characterizations because of the different goals of the authors.[19] Wray is focused on explaining the production of collective

17. Cheon, "In What Sense," 413.
18. Ibid.
19. Ibid., 414.

knowledge in scientific communities.[20] Wray focuses on how collective knowledge can produce knowledge different from knowledge produced by individuals.[21] To me this means that Wray focuses on the connections and epistemic dependence the individuals in the group have. In Wray's characterization of collective knowledge, the individuals in the group depend on each other epistemically for information related to their work that they would otherwise not have. As Cheon notes, Rolin, on the other hand, is focused on explaining the use and prominence of collective scientific beliefs or assumptions.[22] To me this reason makes it acceptable for Rolin that some of the views of the group be reducible to the views of the individuals. The individuals do not need to rely on each other for information like they do in Wray's ICK. For Rolin it is only important that the individuals in the group are jointly committed to putting forward certain beliefs as the knowledge of the group. In jointly committed knowledge, some individuals may be justified in believing the group's views while others may not.

As Cheon points out, differentiating between irreducibly collective knowledge (ICK) and jointly committed knowledge (JCK) is important when it comes to critiques of these theories.[23] For example, Cheon claims Rolin unfairly criticizes Wray's claim that scientific communities cannot have collective knowledge.[24] Cheon argues that Rolin is discussing JCK while Wray is discussing ICK.[25] To further clarify Cheon's point, I will go through Wray's claim, Rolin's critique, and finally where Cheon finds the need for differentiating

20. Cheon, "In What Sense," 414.
21. Ibid.
22. Ibid.
23. Ibid.
24. Ibid.
25. Ibid., 414-415.

ICK and JCK in this case.

K. Brad Wray claims that scientific communities do not have organic solidarity because scientific communities are not functionally dependent on each other.[26] That is in scientific communities each individual does or can acquire scientific knowledge without requiring or depending on another individual within the community. For Wray, it is acceptable that members of a scientific community depend on each other for information but it is also the case that the information is independently achievable by individuals. It is not the case that only in working together as a group can scientific communities produce knowledge.

Similarly, for Wray, when collectives work together, they do not always produce irreducibly collective knowledge.[27] Each collective itself may produce ICK but it is not necessary that one collective epistemically depends on the other in order to complete its work.[28] That is each collective could independently have acquired all the knowledge and information they need. However in some circumstances, one collective may rely on another collective instead of producing some piece of information on its own. For example, it may be the case that there are only enough resources for one collective, a, to do its work. The other collectives may then depend on the knowledge gathered from collective a in order to complete their work because at the time, due to the shortage of resources, the other collectives cannot do the same work that collective a did. In this situation, Wray would argue that the only group with organic solidarity, that is functional epistemic dependence, is collective a and not the collectives working together nor the scientific community to which these collectives belong. Because collective a is the only community with organic

26. Wray, "Who has Scientific Knowledge?," 344.
27. Ibid.
28. Ibid.

solidarity, it is also the only community with irreducibly collective knowledge (ICK).

Rolin's critique of Wray claims that scientific communities do have organic solidarity and therefore, they have irreducibly collective knowledge (ICK). According to Cheon, Rolin claims that members of a scientific community epistemically depend on each other when it comes to defence of default entitlements.[29] Rolin further argues that there is organic solidarity because of the joint agreement to defend default entitlements.[30] Cheon notes that Rolin argues that a scientific community can only defend its default entitlements when the community members depend on each other epistemically.[31] Thus, Rolin argues that Wray is incorrect in saying that scientific communities do not have organic solidarity. Instead, Cheon says Rolin points to the epistemic dependence and therefore, organic solidarity, required in scientific communities when it comes to defending default entitlements. Here is where Cheon disagrees with Rolin and uses the differentiation between irreducibly collective knowledge (ICK) and jointly committed knowledge (JCK) to explain.

Cheon argues that Rolin miss identifies jointly committed knowledge (JCK) as irreducibly collective knowledge (ICK). According to Cheon, K. Brad Wray presented an example of ICK while Rolin presented an example of JCK. Cheon points out that Rolin misses the functional interdependence aspect of Wray's argument.[32] Just because the members of a scientific community agree to work together in defence of a joint commitment, that does not mean that they must work together in a manner that is interdependent.[33] It could be the case that the community defers to a single member for the defence argu-

29. Cheon, "In What Sense," 417.
30. Ibid.
31. Ibid.
32. Ibid., 418.
33. Ibid.

ment or that the community only puts a few members in charge of the defense. It could also be the case that a community uses a consensus to decide which default entitlement to use. A consensus approach does not necessarily mean the members of the community are functionally dependent on each other. The members may have their own reasons for defending the entitlement in question. Thus, Cheon argues that it is because Rolin equates JCK with ICK that Rolin incorrectly argues that scientific communities can have organic solidarity and therefore, irreducibly collective knowledge.

A final distinction that Cheon makes between irreducibly collective knowledge (ICK) and jointly committed knowledge (JCK) is that ICK can be held by individuals despite the knowledge being produced collectively.[34] Cheon argues that there is no reason to infer that knowledge is collectively held when knowledge is collectively produced.[35] Further, when presenting the group's knowledge it is more likely that the individual members will hold the view that the group has collectively produced.[36] Once the knowledge is held by individual members it is no longer acceptable to say that the knowledge is not reducible to the individual group member's views.[37] Once the group has produced a particular piece of knowledge, the knowledge seems to be possessed by each of the members of the group.[38] For example, it may take the collaboration of many scientists to map the human genome because of the volume of data involved and the complexity of the machinery used. However, once the genome is mapped, it seems possible that the individuals working within the collaboration would have justified true beliefs or acceptances related to the mapping of the

34. Cheon, "In What Sense," 119-120.
35. Ibid., 420.
36. Ibid.
37. Ibid.
38. Ibid.

human genome. Once the knowledge has been produced, there is no reason to argue that the members of the collaboration are still interdependent on each other for the possession of the knowledge.

It may be permitted that irreducibly (produced) collective knowledge is held by individuals but how is this ICK justified? That is the subject of ICK could be an individual but is this individual's knowledge justified in the same way that the collective's knowledge is justified? Is there a difference in the knowledge possessed by a person who is part of the collective knowledge production process and a person who has attained the knowledge through transmission? When considering justification, there seems to be a difference between the justification for knowledge that is collectively produced versus knowledge that is individually produced or possessed. In the last section, I present Jeroen de Ridder's version of collective scientific knowledge that is based on how the knowledge in question is justified.

2.3 Jeroen de Ridder on Scientific Knowledge as Collective Scientific Knowledge

In a similar vein to other theories of knowledge, Jeroen De Ridder argues that knowledge is created when the following four conditions are met: "(i) a belief condition, (ii) a truth condition, (iii) a justification condition, and (iv) an anti-Gettier condition."[39] De Ridder argues that instead of focusing on belief like Rolin does, it is more productive to focus on the justification condition of knowledge.[40] Furthermore, the collective does not necessarily

39. de Ridder, "Epistemic Dependence," 42.
40. Ibid.

need to satisfy a stronger condition of collective belief, only a weaker condition of collective acceptance.[41] De Ridder moves to collective acceptance so that it is less important that the collective has a mental state which is often a requirement for having beliefs.[42] Instead, the collective only needs to accept a particular piece of information as knowledge.[43]

Using acceptance instead of belief seems to me a more accurate picture of how scientists currently view scientific knowledge. This is an empirical question that will not be answered here. However, given that the history of science shows continual adjustments and updates to scientific theories along with new discoveries, it seems most accurate to base scientific knowledge on acceptance rather than belief. Part of the driving force in science appears to be a constant skepticism and assumption that there may be more to learn; we should accept what we know now but be open to change in the future. Given this analysis, it is acceptable that I understand condition (i) the belief condition as (i.a) the acceptance condition where acceptance, individual or collective, replaces belief when it comes to determining scientific knowledge. So now the four conditions for scientific knowledge based on de Ridder's view are: (i.a) an acceptance condition, (ii) a truth condition, (iii) a justification condition, and (iv) an anti-Gettier condition. As we saw above, the change in condition (i) to (i.a) makes it possible for collectives to satisfy this condition. According to de Ridder, conditions (ii) is unrelated to the subject of knowledge and therefore, not particularly relevant in this case.[44]. DeRidder also argues that "condition (iv) seems irrelevant for science and is unlikely in general to require collectives for its satisfaction" and therefore, leaves condition (iv) out

41. de Ridder, "Epistemic Dependence," 42-43.
42. Ibid., 42.
43. Ibid.
44. Ibid.

of the discussion.[45] So, to now understand de Ridder's argument for collective scientific knowledge, I, like de Ridder, will focus on a discussion of condition (iii) the justification condition.

De Ridder argues for collective scientific knowledge by showing a difference in how collectives versus individuals satisfy condition (iii) the justification condition. De Ridder begins by defining scientific justification as

> (SJ) A subject S's belief that p has scientific justification only if it is properly based on a properly performed and objectively reliable process of scientific inquiry, the purpose of which was to gather evidence for the truth of p, and S understands this to be so.[46]

De Ridder breaks this definition of scientific justification into five parts:

1. The belief is "properly based on a process of scientific inquiry."
2. "The belief should be an intended outcome of the inquiry."
3. "The process of scientific inquiry should also be properly performed."
4. "The process of scientific inquiry on which the belief is based is objectively reliable in its intended domain of application."
5. The subject "grasp[s] how and why" the knowledge produced is true.[47]

45. de Ridder, "Epistemic Dependence," 42.
46. Ibid., 45.
47. Ibid., 43-44.

De Ridder then argues that in the case of collective scientific knowledge each individual within the collective contributes information that is used to satisfy the parts of scientific justification above. It is only through the combined testimony of each of the individual members that the collective is able to satisfy the scientific justification condition.

There are many reasons why the scientific justification condition may not be satisfied by one particular individual within the collective. For example, it may be an issue of time. It may not be possible for one individual to learn and become proficient in all of the skills required to properly perform the process used in the inquiry within their lifetime. In this case, a few individuals may learn different steps in the process and then work together to complete the entire scientific project. This sort of division of labour de Ridder calls "*practically necessary*" epistemic dependence.[48]

This practical dependence becomes important when trying to satisfy de Ridder's fourth condition for scientific justification. Sometimes, in order for the scientific inquiry to be properly performed, cases of practically necessary dependence can only be satisfied by the collective and not an individual. For example, it took the work of multiple geneticists properly performing multiple experiments in order to complete the human genome project.[49] This collaboration was practically necessary for time reasons. It is possible that one researcher could have done all of the experiments themself but also unlikely that this researcher would have been able to complete all the experiments before they were physically unable to continue to work. Thus, it was practically necessary to have multiple scientists working on the project collecting the same data in the same manner according

48. Original italics. de Ridder, "Epistemic Dependence," 46.
49. Institute, "An Overview of the Human Genome Project."

to the proper procedure.

In order to complete their project members in a collective might be epistemically dependent on knowledge from fellow or past researchers. This may be the case when researchers are working on a project that is interdisciplinary or one that requires multiple areas of high degrees of precision or specialization.[50] I would also point out that scientists who work in fields that have a history of research that informs current theories and processes also rely epistemically and practically on the work of those who came before them. Instead of repeating every discovery, scientists are taught what has already been discovered in their field and use this knowledge to inform work that is currently being done. Researchers may be provided with the justification for or an example of the work done in order to verify this information but they do not perform the experiments themselves. It seems rare now that any one researcher gains all of their knowledge independently of any other scientific researcher.

Epistemic dependence is important when it comes to de Ridder's fifth condition for scientific justification that requires the subject "grasp the how and why" the knowledge produced is true.[51] In order to understand why and how their inquiry produces knowledge researchers in a collective may rely on other researchers in the collective to provide explanations for particular areas. For example, when it comes to interdisciplinary work, each individual researcher brings the how and why explanations from their field. In interdisciplinary work, only a scientific inquiry that combines all of the how and why explanations from each discipline satisfies de Ridder's fifth condition for scientific justification. Alter-

50. de Ridder, "Epistemic Dependence," 46-47.
51. Ibid., 46.

natively, if there are projects that require precision or specialization then each researcher will provide a piece of the justification for their area. For example, projects that require computer programs to analyse or sort through information rely epistemically on the computer programmers to have written the programs properly. Further when asked how and why the data from the program is considered true, it is likely the researcher will defer to the computer programmer for the explanation. Finally, when explaining how or why an inquiry is useful to its scientific domain often the researcher will have to defer to the epistemic authority of fellow or past researchers. Current justifications for research may depend on taking for granted knowledge from previous researchers. Current justifications for scientific knowledge may also use this previous research to challenge conclusions. Either way researchers depend on some of the knowledge provided in these other inquires to explain why and how their inquiry has come about. Further, when explaining the justification for the knowledge used, the researcher may ask another researcher or depend on the recorded (written or otherwise) testimony of the researcher if the researcher is no longer available. In these cases, it is not the individual researcher but the collective that has all of the information necessary to satisfy the how and why condition of scientific justification. It is functionally impossible for an individual within the collective to satisfy the conditions for scientific justification. Only the collective has the means to satisfy all of the conditions.

By focusing on scientific justification de Ridder is not required to defend the claim that a collective (or plural subject) can and does have beliefs. For Cheon and Rolin the question as to whether there can be collective knowledge hinges on the possibility of collectives (or plural subjects) being able to have beliefs. For de Ridder, even if there is no collective belief, the fact that the justification relies on the collective means that the

scientific knowledge produced in that case is collective. This shift in focus is what makes de Ridder's argument for collective scientific knowledge different from the arguments proposed by Cheon and Rolin. De Ridder's approach also has the advantage of not being susceptible to the same criticism that Cheon and Rolin have to deal with when it comes to explaining the possibility of group belief. De Ridder does not have to explain how a collective has one singular belief when the individuals within the group are not able to agree on all of the details related to the belief in question. Nor does de Ridder need to explain how a collective has the proper mental state necessary for belief.[52] For de Ridder, whether the group or the individuals within the group has a belief does not matter. Instead de Ridder follows Wray in arguing that groups can accept views which is not the same as believing a view.[53] What is important to de Ridder is how the accepted piece of knowledge is justified and if this justification relies on just the individual or the collective in order to meet his five conditions for scientific justification. If it is the case that the justification conditions can only be satisfied by the collective then that knowledge is, for de Ridder, irreducibly collective knowledge held by a collective.

An important distinction here needs to be made between Cheon's irreducibly collective knowledge and de Ridder's irreducibly collective knowledge. Recall that for Cheon irreducibly collective knowledge can be held by individuals despite being produced in an irreducibly collective way.[54] For deRidder, however, it is not the case that individuals can hold the irreducibly collective knowledge. This is because the individuals do not, without relying on another individual, have all of the relevant evidence to satisfy the justification

52. de Ridder, "Epistemic Dependence," 42.
53. Ibid.
54. Cheon, "In What Sense," 119-120.

condition. Instead, for de Ridder "an individual's knowledge...is derivative of the collective's knowledge."[55] De Ridder argues that the individual's knowledge becomes derivative because some of the evidence for the justification is based on testimony from other individuals within the collective.[56] If the individual relies on testimonial evidence for their justification then that individual does not "*understand* in a direct way that the process of inquiry on which [their] belief is (ultimately) based is properly performed and objectively reliable, and that the evidence it produces indeed supports [the knowledge]."[57] If this is the case, then theories of testimonial justification will become relevant to the determination of if an individual has scientific knowledge or not and if this scientific knowledge can be derived or acquired from a collective.

De Ridder's argument for collective knowledge seems to be the most consistent with scientific practice.[58] In my experience with science, the more justification there is for why and how a scientific theory is true, the more this scientific theory is accepted and/or believed. The more a scientific theory is accepted and/or believed, the more it is considered scientific knowledge. Thus, if some of this knowledge can only be justified by a collective of scientists, then it must be accepted that there is collective scientific knowledge. For me, accepting collective scientific knowledge is fine until it comes to determining how this collective scientific knowledge is transmitted. Put another way, how can someone or someones acquire collective scientific knowledge based on the collective's testimony? Before I discuss this question, I want to discuss current theories of testimony.

55. de Ridder, "Epistemic Dependence," 48.
56. Ibid.
57. Original italics. ibid.
58. I acknowledge that this claim is not purely theoretical and requires discussion with scientists in a vast array of positions and fields. This thesis however, is restricted to only theory at this time.

Chapter 3

Testimonial Justification in Epistemic Testimony

Up to now, I have described two versions of social scientific knowledge and three kinds of collective scientific knowledge. The discussion on social scientific knowledge led to consideration that more than one individual is involved in the creation and justification of scientific knowledge. This concept of multiple individuals being involved was then extended in Chapter Two when theories of collective scientific knowledge were discussed. In the theories of collective knowledge, both jointly committed knowledge and irreducibly collective knowledge, the collective itself and not the individuals involved hold or justify the knowledge. Now that I have discussed what kind of knowledge there can be, I want to discuss how this knowledge is shared and if our current theories are compatible with collective scientific knowledge. In this chapter, I focus on theories of testimony that describe how knowledge is shared. Specifically, I will focus on testimonial justification which clarifies when the knowledge acquired is considered justified knowledge. This will allow me to discuss in Chapter Four if and how knowledge can be acquired from the testimony of collective scientific knowledge.

Before getting into the theories on testimonial justification, I want to clarify that this discussion is specifically about epistemic testimony (hereafter 'testimony') rather than other types of testimony like legal testimony. I am concerned specifically with testimony of scientific knowledge. That is how scientific knowledge is exchanged or passed on. Under what condition(s) is a recipient or recipients justified in acquiring knowledge based on the testimony of a testifier or testifiers? When is it acceptable to say that someone or a group knows something based on the word of a scientist or group of scientists?

In general, testimony is an action undertaken with the purpose of intentionally exchanging information from one entity, singular or plural, to another. After all, how can something be said if not in the form of an action? This act of communication can be manifested in various ways. The testifier and recipient can be two individuals who are in an informational exchange either in person or using some sort of communication device like a telephone. A testifier may present information in a written form for a general non-specific recipient who could be known or unknown to the testifier. The testifier could be communicating with a future self in the form of a diary or note for later. Likewise, a recipient could be acquiring information from an unknown or known testifier via a written form; through a communication device; or through person communication.

According to Robert Audi, testimony is asserting or saying that.[1] Where S is the testifier giving the testimony and p is the information being asserted or said by the testifier, Audi clarifies that testimony is answering the question "Was it p that S said?" rather than "Did

1. Robert Audi, "Testimony as a Social Foundation of Knowledge" [in en], *Philosophy and Phenomenological Research* 87, no. 3 (2013): 507-508, `http://resolver.scholarsportal.info/resolve/00318205/v87i0003/507%5C_taasfok`.

S say that p?"[2] The difference in the two questions has to do with each question's specificity. In the first question there is generally only a yes or no answer to the question; either S said p or S did not say p. In the second question, there is more room for interpretation. It could be that S said p or that S said something similar to p but not exactly p. S could imply p by using a conditional statement in the form if a then p, where the testifier says a in order to imply p. For instance, if I am asked, "Do you want a coffee this morning?" I may answer, "Is the sky blue?" but mean "Yes. I do want a coffee." If we consider Audi's questions and are asked, "Was it 'Yes. I do want a coffee' that S said?", the answer would be "No." I did not say that. If we ask, "Did S say they want a coffee?", then the answer would be, "Yes. Kind of. In a manner of speaking they said that." In a way, I did say I want a coffee. I implied it by asking a question that had the same answer as the one I would have given if I gave a yes or no answer. What this distinction makes clear is that testimony is not just saying something nor is it just an exchange of information. Something more is needed to understand testimony.

Jennifer Lackey characterizes testimony as an "*act of communication* ... [including] both verbal and written assertions as well as communicative physical gestures, such as nods, points, and so on."[3] Specifically, for Lackey,

> S testifies that p by making an act of communication a if and only if (in part) in virtue of a's communicable content, (1) S reasonably intends to convey the information that p, or (2) a is reasonably taken as conveying the information that p.[4]

2. Audi, "Testimony as a Social Foundation," 507.
3. Original italics. Lackey, "Introduction," 3.
4. Original italics. ibid.

Lackey further distinguish between communicable content and perceptual content. Lackey makes this distinction in order to separate out instances where something is said as an example versus when something is said in order to relay information. Lackey uses the example of a testifier "sing[ing] 'La la la' in a soprano voice".[5] Here the testifier is not providing the information 'la la la' but is instead using an example to provide perceptual content for the recipient. Audi too distinguish between testimony and uttering where "uttering is possible even for a parrot" because uttering is "merely phonetic saying".[6] Like Lackey, testimony for Audi must include more than just copying of words. There must be, as mentioned earlier, a "saying that" or asserting of something.[7]

When is there testimonial justification? In other words, when is the recipient justified in forming true beliefs or acceptances based on the testimony of the testifier.[8] The rest of this chapter will discuss three approaches on testimonial justification: the non-reductionist approach, the reductionist approach, and the dualist approach.

3.1 Non-Reductionist Approach to Testimonial Justification

According to Jennifer Lackey[9], a non-reductionist approach to testimonial justification assumes that knowledge acquired from testimony is in general justified if the testimony

5. Lackey, "Introduction," 3.

6. Audi, "Testimony as a Social Foundation," 508.

7. Ibid., 507-508.

8. It is important to note that how knowledge is defined will play a role in how this question is answered. Often as was seen in Chapter One, the definition of knowledge includes a form of 'justified true belief or acceptance'. While it is both interesting and important to consider if this definition of knowledge is accurate and useful I do not have space in this thesis to make a fair examination of the topic. For simplicity, the rest of this thesis will continue to use the definition of knowledge as justified true belief or acceptance.

9. Lackey bases their general definition on many versions of non-reductionism. For a list of these works see note 19 in "It Takes Two to Tango."

is reliably produced and the recipient has no reason to think the testimony is not true.[10] There are *psychological defeaters* that include "an experience, doubt, or belief that is had by [the subject], yet indicates that [the testifier's] belief that p is either false or unreliably formed or sustained."[11] There are also *normative defeaters* that include "a doubt or belief that [the subject] ought to have, yet indicates that [the subject's] belief that p is either false or unreliably formed or sustained."[12] According to Jennifer Lackey, this means that non-reductionists do not require any positive reasons for accepting testimony.[13] As long as there is no reason to doubt the testimony of the testifier, the recipient has testimonial justification for the knowledge acquired. The recipient can form justified true beliefs or acceptances based on the testimony of the testifier. For example, I am justified in acquiring from my elementary school teacher the knowledge that p 'as the mercury in the thermometer rises, the temperature is increasing' as long as I believe my teacher has given me reliable information and I have no defeaters relevant to the knowledge p. As long as I do not have any psychological or normative defeaters that contradict the information I receive from my elementary school teacher, I am justified in acquiring the knowledge from them that p 'as the mercury in the thermometer rises, the temperature is increasing.' Alternatively, say there is a collaboration between a physicist and a biologist on a scientific project. According to non-reductionism, the physicist can accept the testimony of the biologist if the testimony is reliable and the physicist has no defeaters. If both scientists agree to adhere to what they determine is a reliable method of inquiry, they can say that the testimony is reliable.

10. Lackey, "It Takes Two to Tango," 166.
11. Original italics. Lackey, "Introduction," 4.
12. Original italics. ibid.
13. Ibid.

Further, each scientist will likely have no defeaters for the knowledge presented by their colleague since they only specialize in their respective disciplines. The physicist can say that the testimony of the biologist is reliable and that they have no defeaters and vice versa. According to the non-reductionist approach, both the physicist and the biologist in this collaboration have testimonial justification for the knowledge acquired from their colleague.[14]

Lackey is concerned that a non-reductionist approach is too one-sided. According to Lackey, non-reductionism only requires that the recipient assess the reliability of the content and confirm the absence of defeaters.[15] This approach presents a problem when the recipient is unable to assess the reliability of the testifier. For example, say a person comes up to me in the coffee shop and says, "When the mercury in a thermometer rises, the temperature is increasing." I do not know for sure if the testifier is reliable nor do I have reason to think that they or the information they provide is unreliable. Further, I do not have any defeaters with regard to this statement. I do not have any counter-evidence or counter-beliefs that would make me question the information I have received from this stranger. According to the non-reductionist approach, I am justified in my knowledge that when the mercury in a thermometer rises, the temperature is increasing based on the testimony of the stranger in the coffee shop. Does my knowledge actually meet the requirements for knowledge? That is, do I have a justified true belief or acceptance that as

14. It is unclear if this is an accurate characterization of scientific testimony and how knowledge is relayed in scientific communities. An empirical study may be beneficial in determining current practices and may inform further discussions on how scientific testimony is dispersed. My goal in this thesis is not to answer this empirical question but instead to understand what issues may arise given the approaches to testimonial justification that are available, particularly with respect to collective scientific knowledge. The empirical question will hopefully be taken up in a later project.

15. Lackey, "It Takes Two to Tango," 166-169.

the mercury in a thermometer rises, the temperature is increasing? According to the non-reductionist approach, because I have no defeaters indicating otherwise, I can acquire the justified true belief or acceptance that as mercury in a thermometer rises the temperature is increasing. The problem for Lackey, in this case, is that there is no way to determine for sure if the person in the coffee shop is reliable. So, either it needs to be assumed that the person is reliable or determined that this is not a case of testimony. The other problem here is that sometimes we need to proceed based on the knowledge from someone else in situations like this where reliability of the testimony cannot be determined. For scientific knowledge in particular this may more frequently be the case because of the immense amount of information required to understand some scientific concepts. While someone can be reasonably certain that a fellow scientist is reliable, it is also possible that a fellow scientist is unreliable in a particular situation. Further it is difficult to determine the reliability of the science in general because of our own lack of expertise in the area. So, Lackey's point that a non-reductionist approach to testimonial justification is insufficient on its own, has some merit.

Robert Audi presents a slightly different view where experience is needed for the knowledge gained to be justified.[16] This experience, claims Audi, provides the recipient with an account of when testimony is reliable. Reliable testimony is undefeated testimony. For Audi, undefeated testimony is testimony "that occurs in the absence of ... common and probably most characteristic defeaters."[17] The main take away from Audi's view is that there is in general a collection of evidence that a recipient uses to determine if the testimony

16. Audi, "Testimony as a Social Foundation," 523-525.
17. For a more detailed description of undefeated testimony see the section by that name in ibid., 524-525.

in any particular instance should be accepted. Further, the more someone experiences instances of testimony, the better one is at determining when testimony will be a reliable source of justified knowledge.

Audi's characterization of testimony gives an account that provides a solution to the concern Lackey has. In Audi's version of testimony, the recipient is likely to have some sort of experience that will help determine the reliability of the testifier in question. Even if the recipient is not certain of or ignorant of the reliability of a particular testifier in a particular instance, the recipient can use their experience to make judgements or educated guesses. Further, if the recipient is ignorant, as in Lackey's example, then Audi says the recipient still acquires knowledge it is just unjustified knowledge.[18] Presumably, as the recipient gains experience, the recipient can assess the reliability of current and past testifiers. This assessment can then determine how justified the knowledge is and indicate if adjustments are required. Though Audi does not claim to adhere to a non-reductionist nor a reductionist approach to testimonial justification, the notion of reliability based on experience is similar to the reductionist approach to testimonial justification that I will discuss in the next section.

3.2 Reductionist Approach to Testimonial Justification

In the reductionist approach, testimony is only justified if there are non-testimonial positive reasons for thinking the testimony is reliable. Thus, it could be said that the justification for testimony reduces to non-testimonial reasons like "sense perception, memory, or in-

18. Audi, "Testimony as a Social Foundation," 521.

ductive inference".[19] Reductionism comes in two forms: global reductionism and local reductionism.

3.2.1 Global Reductionist Approach

According to Lackey, in global reductionism "a [recipient] must have non-testimonially based positive reasons for believing that *testimony is generally reliable.*"[20] This means that a person must have positive reasons based on either sense perception, memory, or inductive inference for believing that the testimony they hear is reliable.[21] For example, if I am to believe that, "as the mercury in the thermometer rises, the temperature is increasing" based on the testimony of my mother, I must have good, positive, non-testimonial reasons for believing that my mother is a reliable testifier. These reasons could include the fact that my sense perception has confirmed other instances of testimony by my mother like 'the temperature increases when I feel warmer' or 'I see with my eyes that the mercury in the thermometer moves.' Because I have good positive reasons to accept the testimony of my mother in both of these other instances, I have good positive reasons to accept her testimony in general. My mother's testimony was reliable when it came to increasing temperature and feeling warmer and when it came to seeing mercury move in a thermometer. Therefore, in general when my mother tells me something it is most likely reliable. This is where we see the similarities and differences between Audi's view of testimony and the reductionist approach to testimonial justification. In Audi's case, reliability is determined by expertise while the reductionist approach uses non-testimonial positive reasons. Audi, however,

19. Lackey, "Introduction," 5.
20. Original italics. Lackey, "It Takes Two to Tango," 161.
21. Ibid., 160-161.

allows unjustified knowledge simply based on testimony which is more similar to the non-reductionist approach to testimonial justification. According to the global reductionist approach, the testimony can only become justified knowledge, that is justified true beliefs or acceptances, if there are good non-testimonial positive reasons for believing the testimony is reliable.

Jennifer Lackey points out that there are problems with the global reductionist approach. First, at some point in the stages of learning there seems to be a necessity for accepting testimony before its reliability can be determined.[22] For example, a child may require the testimony of a parent in order to understand the sense perceptions it has acquired before this child is sure that the testimony of their parents is reliable.[23] Second, "one would have to be exposed not only to a non-random, wide-ranging sample of reports, but also to a non-random, wide-ranging sample of the corresponding facts."[24] This is a problem because any one individual would not be able to acquire enough data on their own to justify global reductionism in a way that would be considered sufficient for proof.[25] Further, I would point out that some individuals are not able to comprehend the connections in the data in order to explain their justification; they are unable to explain exactly how and why they have enough non-testimonial data to confirm that global reductionism is reliable. Therefore, in these cases, they would have to rely on some form of testimony to make the connection between their non-testimonial data and the testimony this data is said to support. Finally, Lackey believes the most damaging concern with global reductionism

22. Lackey, "It Takes Two to Tango," 161.
23. Ibid.
24. Ibid.
25. Ibid.

is that it assumes that there is a connection between instances of testimony and testimony as a whole general concept.[26] More specifically it assumes that testimony in general is reliable and that this means that instances of testimony are also reliable. However, Lackey argues there is no reason that this should be so. The general reliability of any instance of testimony is only somewhat guaranteed by the notion that testimony in general is reliable because there are instances of mistaken testimony or accidentally true testimony.[27]

3.2.2 Local Reductionist Approach of Testimony

According to Lackey, the local reductionist approach attempts to maintain reduction to non-testimonial reasons while not being subject to the same problems as the global reductionist approach. In the local reductionist approach, "*each particular report or instance of testimony* reduces to the justification of instances of sense perception, memory, and inductive inference."[28] Unlike global reductionism, local reductionism does not need to extend the reliability of testimony in general to the reliability of a particular instance. It also does not need to gather an impossible amount of data in order to support its claims. So, there are some advantages to local reductionism over global reductionism but local reductionism still has some challenges.

Lackey argues that the reliability of the local testimony is not guaranteed by reduction to good positive reasons.[29] For example, even though someone may have good positive reasons to believe the testimony of someone it may still be that case that the testimony is incorrect. Lackey argues this point, using her NESTED SPEAKER example, where Fred

26. Lackey, "It Takes Two to Tango," 161-162.
27. Ibid., 162.
28. Original italics. ibid.
29. Ibid., 163-164.

accepts the testimony of Pauline that "albatrosses ... have the largest wingspan" based on the reliable testimony of Helen.[30] It turns out that Pauline does not have good positive reasons for her claim and just happens to be right in this instance. Lackey argues in this case that though there are good positive reasons for Fred to believe Pauline (ie. the reliable testimony of Helen), we would say that Fred has not gained knowledge about albatrosses. Lackey argues that Fred has not gained knowledge because the source of Fred's knowledge, Pauline, is not reliable. Even though Fred had good non-testimonial positive reasons that support the belief in question, the testimony from Pauline was not reliable because Pauline did not have good non-testimonial positive reasons.[31] Again, Lackey is concerned with the fact that because the focus is on if the recipient has good non-testimonial positive reasons, there are no requirements with regard to the reliability of the source, that is the reliability of the testifier. So, for Lackey local reductionism is also not a good approach to testimonial justification.

An alternative concern I have with the local reductionist approach is the underdetermination of evidence. Underdetermination of evidence, as we saw in Chapter One, recognizes that independent non-testimonial positive reasons or evidence can support multiple conclusions or theories. So, if the only requirement for testimonial justification is independent non-testimonial positive reasons, then conflicting testimony could be supported by the same evidence. If the goal is to find a theory of testimonial justification that explains how knowledge can be acquired through testimony, underdetermination could be a problem for the local reductionist approach. At the very least, underdetermination shows that

30. Lackey, "It Takes Two to Tango," 163.
31. Ibid., 164.

local reductionism on its own can not differentiate between two equally likely justified true beliefs or acceptances. In response to these concerns with both non-reductionism and reductionism, Jennifer Lackey proposed dualism which I will now explain in the next section.

3.3 Jennifer Lackey on Dualism

When it comes to testimonial justification, Jennifer Lackey argues there is an alternative to the traditional focus on supporting either non-reductionism or reductionism. Lackey argues instead for a theory called dualism that is based on the "*dual* nature" of testimonial justification.[32] According to Lackey, testimonial justification must include elements from both non-reductionism and reductionism. Specifically, Lackey defines dualism as

> *Dualism*: For every [testifier] A and [recipient] B, B justifiedly believes that p on the basis of A's testimony that p only if: (1) B believes that p on the basis of the content of A's testimony that p, (2) A's testimony that p is reliable or otherwise truth conducive, and (3) B has appropriate positive reasons for accepting A's testimony that p.[33]

Let's look at this definition more closely.

First, as mentioned earlier, Lackey views testimony as an act of communication that involves the exchange of information.[34] It is not just that the testifier says something and the recipient forms beliefs based on their observation of the testifier. Remember, from the

32. Original italics. Lackey, "It Takes Two to Tango," 170.
33. Original italics. ibid.
34. Lackey, "Introduction," 3.

beginning of the chapter the examples of "sing[ing] 'la, la, la' in a soprano voice"[35] or Audi's example of a parrot repeating phrases[36]. In both of these instances, words and phrases are being said or uttered but only as a demonstration and not as a means of communicating.

Second, Lackey requires that the testifier's testimony be "reliable or otherwise truth conducive."[37] When it comes to the content's reliability, the content might be "*sensitive*... - the [testifier] would not state that p if p were false - or *safe*... - the [testifier] would not state that p without it being so that p."[38] An approach that relies on the content being reliable means that the recipient does not need to assess the reliability of the testifier themself or can be ignorant with respect to the testifier's reliability. In the case of the scientists, this means that the recipient can proceed on the testimony of their fellow scientists as long as they believe that the scientists are providing reliable statements. Presumably if the scientists are working together on a project, they would want to provide reliable information to their fellow scientists so that the project would proceed and be successful.

Whether reliability is determined based on the reliability of the testifier or reliability of the content what is important for Lackey's dualism is that there is some assessment of reliability. It also does not seem necessary for both the testifier and the content to be reliable. Lackey leaves it up to interpretation what being reliable or otherwise truth-conducive means. I will discuss the impact of the openendedness of this condition on collective scientific knowledge in the next chapter. Right now I will move on to the third part of dualism.

35. Lackey, "Introduction," 3.
36. Audi, "Testimony as a Social Foundation," 508.
37. Lackey, "It Takes Two to Tango," 170.
38. Ibid., 171.

The third part of dualism requires that the recipient, "B has appropriate positive reasons for accepting A's testimony that *p*."[39] This condition comes from reductionism where the recipient must have good non-testimonial positive reasons for believing the testimony.[40] Lackey allows this condition to be slightly more relaxed. For Lackey, the role of the positive reasons is "that they render it, at the very least, *not irrational* for [a recipient] to accept the testimony in question."[41] Because dualism splits the burden of justification between both the reliability of the testimony and the positive reasons, Lackey does not have to deal with the problem of showing that only non-testimonial positive reasons support the testimony. This means that testimony can be used to provide justification as long as it is determined to be reliable.[42]

Allowing reliable instances of testimony to support other instances of testimony helps avoid concerns regarding the jump from the general reliability of testimony to particular instances of testimony and concerns regarding the massive amount of knowledge required to be confident in the positive reasons used. For example, in the case of the scientists, it is not necessary to argue that because all scientists are reliable, these particular scientists are reliable. Instead, with dualism, it would need to be shown that these scientists are reliable, that their content is reliable, or at the very least, that there are no reasons to believe the testimony is not reliable. Further, this assessment of reliability would be combined with positive reasons for believing the testimony. Part of determining if the testifier is reliable includes determining if the testifier has properly acquired the knowledge in question. If it

39. Original italics. Lackey, "It Takes Two to Tango," 170.
40. Ibid., 160.
41. Original italics. ibid., 172.
42. Ibid., 173.

is determined the testifier has, then it is no longer necessary for each scientist to collect all the information required to provide only positive-reasons to support the testimony. Thus, it can be determined that each scientist is reliable (or that there is no reason to think they are unreliable) and that there are good positive reasons for it being rational for one scientist to believe the testimony from another.

Again, Lackey leaves the kind of positive reasons for determining the reliability of the testimony open-ended. Lackey recognizes "at least three classes of inductively based positive reasons that are available to epistemic agents for distinguishing between reliable and unreliable testimony."[43] These include "*contexts* and *contextual features*", "different kinds of *reports*", and "reliable [testifier]s."[44] When it comes to contexts and contextual features Lackey is allowing for cases in which the recipient has positive reasons for thinking that some contexts or contextual features are more reliable than others. For example, based on experience, one scientist may determine that when discussing knowledge in a lab or classroom setting, fellow scientists are more reliable than say when they discuss knowledge in a bar or social setting. It may also be the case that scientists believe that testimony presented in a peer review journal is more likely to be reliable than say testimony on a personal website or blog. This may be because the scientist has positive reasons like experience being a peer reviewer that leads this scientist to expect more reliable testimony in a peer review journal rather than a website or blog.

When it comes to reports, Lackey points out that recipients will have positive reasons for believing some kinds of reports and positive reasons for not believing some kinds of

43. Lackey, "It Takes Two to Tango," 173.
44. Original italics. ibid.

reports. For example, some reports on things like a person's hair colour or favourite book may be assessed as reliable because the recipient has positive reasons to believe most testifiers would not falsify this information. On the other hand, a recipient may have positive reasons for being cautious with respect to certain reports where for example bias can influence the testifier's testimony. For example, if a testifier comes from a company who would profit from giving particular testimony, this may give some positive reasons for the recipient to question the reliability of the report. It may also be the case that previous reports of the same nature have been shown to be false. In the case of the scientists, the reports the scientist produce may be considered reliable reports in some circumstances but less likely to be reliable in other situations. For example, there may be positive reasons like previous experience with reports from scientists working in a particular lab where the reports have been shown to contain altered or false data. Conversely, there may be positive reasons, like having replicated previous experiments based on reports from a lab that make it likely that other reports from that lab are reliable.

The final class of inductively positive reasons for reliable testimony that Lackey gives is reliable testifiers. A recipient may have positive reasons for thinking that certain testifiers are reliable sources of information in certain situations. For example, a recipient may have positive reasons indicating that a biologist is generally a reliable testifier when it comes to information on biological entities like animals or plants. However, there may be positive reasons indicating that a salesperson is not a reliable testifier when it comes to information about biological entities like animals or plants. As a reminder, these positive reasons would need to be non-testimonial reasons like experience, perception, or logical reasoning.

Like we saw with condition 2, what is important for Lackey is that there are positive

reasons. Which class is used is not as important and it seems possible that positive reasons from one or all of the classes may be used to assess the reliability or unreliability of testimony. I should also clarify that using the word positive does not in this sense mean that the reasons must support the reliability of the testimony. It is possible for the reasons to also support an assessment that the testimony is unreliable. Though her definition is not formulated this way, her discussion in "It Takes Two to Tango: Beyond Reductionism and Non-Reductionism in the Epistemology of Testimony"[45] suggests that the definition can be used to assess the unreliability of testimony. That is, it appears to be the case that if the testimony in question does not meet all of the conditions laid out, then the testimony should be considered unjustified. Does collective knowledge meet the conditions Lackey has laid out in her definition of dualism? Lackey has presented dualism as a solution to the problems associated with non-reductionism and reductionism. So, if collective scientific knowledge does not meet these conditions for testimonial justification, is there any form of testimonial justification that would be consistent with collective scientific knowledge? In the next chapter, I discuss the possibility of collective scientific knowledge meeting the requirements for testimonial justification in non-reductionism, reductionism, and dualism.

45. Lackey, "It Takes Two to Tango."

Chapter 4

Testimony of Collective Scientific Knowledge

I have now come to the point where I can discuss the main question of this thesis. Is it possible for our current theories of testimonial justification to explain when a recipient is justified in acquiring knowledge from the testimony of a collective of scientists? Can our theories of testimonial justification, as described in Chapter Three, be applied to the kinds of collective scientific knowledge described in Chapter Two? As described in Chapter Three, there are different ways knowledge can be transmitted and there are different conditions required for the exchange of knowledge. Non-reductionist approaches assume knowledge is transmitted unless there are reasons to think otherwise.[1] Reductionist approaches focus on what positive reasons there are to accept the information that is exchanged.[2] Jennifer Lackey's dualist approach needs both reliability of the testifier and positive reasons to justify the exchange of knowledge content though testimony. In the dualist approach there needs to be a reliable or otherwise truth conducive testimony, good non-testimonial reasons in favour of the testimony and the belief formed must be based on

1. Lackey, "Introduction," 4.
2. Ibid., 5.

the content of the testimony.[3]

In Chapter Two we saw that the members of the collective depend on each other in order to produce their knowledge. In Rolin's joint commitment, the collective commits to defending its default entitlements.[4] In de Ridder's collective scientific knowledge the justification for the knowledge is only possible with the input of multiple members.[5] In both of these versions of collective scientific knowledge, there are two kinds of testimony. There is testimony when the collective shares its knowledge and testimony within the collective. It seems fair then that when assessing testimonial justification related to collective knowledge both kinds of testimony need to be addressed. In order to be consistent with the theories, both kinds of testimony should be able to meet the conditions for the theory involved.[6] For example, if we want to be consistent with the non-reductionist approach, then both kinds of testimony must be reliable and there must be no defeaters. If we want to be consistent with the reductionist approach, then both kinds of testimony must have non-testimonial positive reasons that support the reliability of the testimony. In dualism, both kinds of testimony must be based on content, be reliable, and there must be positive reasons for believing the testimony.

My main concern is whether our current theories of testimony can account for the two kinds of testimony in collective scientific knowledge and for the interaction of these

3. Lackey, "It Takes Two to Tango," 170.

4. Rolin, "Science as Collective Knowledge."

5. de Ridder, "Epistemic Dependence."

6. It was brought up by a reviewer that a pluralist approach may solve this issue. However, the following analysis will show that none6 of the the theories on testimonial justification provide enough information at present to assess the impact of the assessment of justification of the individual testimony within the collective on the assessment of the justification of the testimony of the collective. More research into this impact will need to be done in future works including consideration of a pluralist view.

two kinds of testimony. I will begin my analysis with collective scientific knowledge and the non-reductionist approach. Then I move to a discussion of Deborah Tollefsen's group testimony based on a form of local reductionism along with my analysis of how this impacts collective scientific knowledge. Finally, I will discuss collective scientific knowledge and the dualist approach.

4.1 Collective Scientific Knowledge and Non-reductionism

As we saw in Chapter Three, in a non-reductionist approach of scientific knowledge, knowledge acquired based on testimony is justified as long as the testimony is reliably produced and there are no defeaters.[7] When we say testimony is reliably produced, is it that the testifier is reliable, the content is reliable, the process is reliable, or a combination of all of these? My understanding of reliable production is that the process is reliable and therefore, that the content produced is reliable. This would also mean that the testifier would be reliable if they adhere to the reliable process. So, it seems like the answer to the question above is a combination of all of them. Thus, in order to have a useful non-reductionist approach to collective scientific knowledge, we must have a way of determining the reliability of the process, the testifier, and that there are no defeaters.

If we look back on what we learned in Chapter One, there is a process for creating reliable knowledge. Longino's critical contextual empiricism provides a process that includes accounting for social factors and the uptake of as much criticism as possible.[8] Knowledge produced in this way seems more than capable of meeting the requirements for being re-

7. Lackey, "It Takes Two to Tango," 166.
8. Longino, *The Fate of Knowledge*.

liable. Further, as long as the testifier adheres to the conditions of critical contextual empiricism, the testifier could also be assessed as reliable. In my analysis, the question as to how reliable a testifier is, seems most consistent with a notion of degrees of reliability. Similar to how Longino admits that critical contextual empiricism is an ideal only achievable in degrees, reliability of testimony should also be considered an ideal that can only be achieved in degrees. I admit that my theory on what constitutes ideally reliable testimony is still being worked out but I would like to put forward a few initial comments here.

If it is the case, that there is an ideal process for producing reliable scientific knowledge, this process could similarly be applied to producing reliable testimony. One of the benefits of the community based approach that Longino takes is that it allows for and encourages, a great deal of varied criticism. This varied criticism makes it more likely that the knowledge created has taken into account as many perspectives and alternatives as possible. I would like to suggest that the reliability of testimony could similarly benefit from a community based approach. In this community based approach to reliability of testimony, the community would provide the setting within which the reliability of the content, process, and testifier could be analysed and criticised. I would also suggest that like in critical contextual empiricism the reliability of the testimony could only be assessed in terms of degrees of reliability. There are different reasons why any given testimony could be more or less reliable. It could be that the community within which the testimony is being assessed only more or less meets the criteria set out for the ideal community. In an ideal community all possible criticism and perspectives on the reliability of testimony would be considered. However, in reality it is unlikely that one community would be able to provide all of these perspectives and therefore, would only be able to provide as many

perspectives as are available. Therefore, it would need to be said that the testimony is only reliable to a particular degree based on the amount of perspectives available. It could also be the case that perhaps only some parts of the testimony's reliability are available to the community. For example, the community may be able to assess the reliability of the process of testimony creation but not be able to asses the reliability of the testifier because all of the features of the testifier, like say, all of a scientist's credentials, are not available. In this case, again, it would need to be that the reliability of the testimony is only the degree to which what is available has been assess as more or less reliable. As mentioned before, these are only initial thoughts on this topic of community based reliable testimony and further expansion and discussion of alternatives will be necessary. What is shown here is that there is a way to meet the conditions (at least to a certain degree) for a non-reductionist approach to testimonial justification of scientific knowledge held by an individual. Can this approach be extended to collectives that are epistemically dependent on each other?

I believe Longino's critical contextual empiricism could be extended to collectives if we consider a form like de Ridder's irreducibly collective scientific knowledge. In this case we could focus on whether the content could be considered reliable because it resulted from being part of a community of individuals that adhered to the conditions of critical contextual empiricism. It would be necessary to show that the individuals within the collective adhered to the conditions of critical contextual empiricism and that only that knowledge was used in order to justify the collective's knowledge. It is possible that this is a complete misunderstanding and misuse of Longino's theory. However, it seems like critical contextual empiricism is the best way to ensure that knowledge content is the most reliable

or in Longino's words "epistemically acceptable".[9] In order for knowledge content to be used in testimony within a collective is should be as epistemically acceptable as possible. It should be created in a community that has public venues, critical uptake, public standards, and tempered equality of intellectual authority.[10] In fact, knowledge created in accordance with critical contextual empiricism seems to fit well with a non-reductionist approach to testimonial justification. Again, as with the reliability of an individual's testimony, the reliability of the scientific knowledge content of an irreducible collective would only be achievable to a matter of degree. Also, again, this degree of reliability would be contingent on the degree to which the conditions of the ideal community are met by the collective in question. What is important now is that to a certain degree the reliability of the content of the collective could be assessed and thus that the first condition for the non-reductionist approach to testimonial justification is similarly to some degree satisfied. In order to consider the consequences of using a non-reductionist approach to testimonial justification with respect to collective scientific knowledge, I will proceed with my analysis on the basis that some degree of reliability meets the initial requirement for reliable testimony in a non-reductionist approach. I will at this time leave further analysis of the impact of degrees of reliability on testimonial justification to further works.

If it is determined that the knowledge is epistemically acceptable, that is reliable, then it make sense that unless the recipient has defeaters indicating otherwise, the recipient should be justified in acquiring knowledge based on the testimony of this epistemically acceptable knowledge. This would mean that a recipient would be justified in acquiring

9. Longino, *The Fate of Knowledge*, 135.
10. Ibid.

scientific knowledge from a collective provided the recipient has no defeaters. So, if we use this non-reductionist approach then in general scientific knowledge will be justified unless there are reasons to doubt the scientific knowledge.

There are a few problems with this when it comes to collective scientific knowledge. The first problem is that if you simply trust the reliability of the scientist or group then if the scientist or group is incorrect, they or it can provide justified testimony that results in false claims. This is dangerous with scientific claims because of the authority attached to science. Science is used to make life and death decisions as well as create technologies that could be extremely harmful. For example, policies or advocacy could spread based on information from retracted articles. This could explain how retracted scientific articles remain in use following their retraction. Relying on something like the peer review process and a non-reductionist approach to testimonial justification could result in errors being compounded. Having trust in the collective's reliability without requiring reasons to support this reliability could result in approval of a study for publication that should not be. Further, if this article is retracted but a person who finds the published version assumes published articles are reliable, this information could then be used to justify knowledge if the recipient does not have any defeaters or reason to think that the article was not reliable.

Of course a counter argument to this claim would be that the defeater based on the fact that the article was retracted should and would have been present had the recipient been more diligent. Therefore, the new knowledge would not be considered justified because there is in fact defeaters for this testimony that were not accounted for. In response though, knowing that some papers are retracted and that you should look for information

on retractions for all paper sources doesn't mean that you are aware of this defeater. Here is where Lackey's criticism of non-reductionism comes into play.[11] If the recipient is in a state of ignorance with respect to the reliability of the testimony or I argue, the common defeaters, then it seems unreasonable that they would be able to acquire justified knowledge in these circumstances.

With scientific knowledge, collective or individual, it is the case that most people are going to be unable to produce defeaters for scientific knowledge they do not fully understand. Proper training to acquire scientific knowledge is generally considered the reason why those who give testimony are justified in what they are saying. The process of acquiring scientific knowledge is done by those individuals who take up the task of adhering to the scientific knowledge production process. In turn, these individuals are entrusted to relay this scientific knowledge so that other people can focus on acquiring other types of knowledge. This is an individualist account of how and why scientific knowledge is not created and acquired by everyone. I will now discuss whether this account can be extended to groups of individuals like those found in collective scientific knowledge.

The collective can and should be in a position to adhere to the same scientific process as an individual. It is just the case that a collective divides the labor in this process among the individuals within the collective instead of relying on one individual to fulfill all of the requirements. Further, if a notion of irreducibly collective scientific knowledge like that of de Ridder is used, then it may be even more difficult for defeaters to be found. According to de Ridder, the knowledge created is irreducibly justified by the epistemic dependence of

11. Lackey, "It Takes Two to Tango," 167-169.

the members of the collective.[12] That is the only way the scientific knowledge produced is justified is only if all of the knowledge of the collective is consider together. Each individual within the collective depends on the other individuals for some piece of knowledge that assists in support of the collective's knowledge. In order to provide proper critique and therefore, defeaters for this knowledge, a similar but independent collective would need to be produced. Given the vast amounts of scientific knowledge, it may not be possible for another independent collective to be produced. This in turn would mean it may not be possible for there to be sufficient understanding of the collective knowledge in question for defeaters to be made apparent. It is possible however, that this concern could be addressed by the recognition that some scientific knowledge is given an ambiguous status when it comes to the knowledge's reliability. Perhaps this is why some scientific knowledge is classified as hypothesis, theory, and speculation where as other scientific knowledge is considered more reliable and fact based. I propose that an empirical study may be helpful in understanding how scientific knowledge is classified and thus to what extend defeaters may be discoverable. Regardless, concern about defeaters is not my only issue with a non-reductionist approach to testimony of collective scientific knowledge.

Collective scientific knowledge further complicates this issue by having two kinds of testimony. First, those within the collaboration depend on the testimony of the others. Then, there is testimony by the collective of its collective scientific knowledge. Because of this situation, it is possible that there could be a compounding of errors when the collective uses unjustified testimony and in turn presents collective scientific knowledge based on that unjustified testimony. Any errors that were made because of the unjustified testimony of

12. de Ridder, "Epistemic Dependence."

the individuals within the collective would then be passed on. This could possibly result in more errors being made by the collective or those that use the testimony of the collective. This raises the question of whether the current non-reductionist approach says anything about kinds of testimony dependent on testimony and how this impacts the testimony of an epistemically dependent collective and not just an individual.

If the non-reductionist approach depends on the reliability of the testimony and the absence of defeaters then these seem to be the two conditions that a collective would need to satisfy in order for knowledge based on its testimony to be justified. The reliance on the testimony of others within the collective must then be wrapped up in the determination of the reliability of the collective's testimony. In "It Takes Two to Tango: Beyond Reductionism and Non-Reductionism in the Epistemology of Testimony", Lackey focuses on the reliability of the testimony by discussing assessment of "the [testifier] being both a competent believer and a sincere testifier".[13] This, however, is a very individualistic approach and when considering collective scientific knowledge, a different approach may be necessary.

In my view, it may still be possible to adhere to the conditions of a competent believer and sincere testifier if we consider the collective as a whole. After all, the members of the collective are epistemically dependent on each other. Whether it is Rolin's joint commitment version or de Ridder's irreducibly collective knowledge, in both versions the knowledge is ascribed to the collective and not the individuals within the collective. If we think of the collective as one entity that holds the knowledge then we could discuss whether this entity is a competent believer and a sincere testifier. This brings up the ques-

13. Lackey, "It Takes Two to Tango," 166.

tion whether or not a group of individuals can be a believer or hold beliefs. As described in Chapter Two, if it is determined that groups of individuals do not have the ability to hold beliefs then this is a problem for Rolin's jointly committed knowledge. Chapter Two also showed that group belief is less of a problem for de Ridder's irreducibly collective knowledge. De Ridder's irreducibly collective knowledge allows either belief or acceptance and therefore, seems to get around the issue of determining the ability of groups to hold beliefs. So, it seems possible that a version of collective knowledge could be a competent believer but what about a sincere testifier?

Sincere testifiers would likely have similar conditions to reliable testifiers. As I discussed earlier, there are a few ways for the reliability of a collective to be assessed. A critical contextual empiricist approach could be used to show that the collective has been through a processes that creates the most reliable knowledge possible. Further, the critical contextual empiricist approach could ensure that the collective is using thoroughly criticised testimony from the individuals within the group. Alternatively, a version of assessing the trustworthiness of the collective could be used. This approach could be similar to the approach found in the next section where Deborah Tollefsen extends the conditions for determining trustworthiness in individuals to trustworthiness in groups.

Since collective scientific knowledge depends on the combined epistemic knowledge of the collective, it seems imperative that the testimony of the individuals within the collective is at some point assessed as well. However, it is not clear that a non-reductionist approach can be used to make this assessment. This section showed that while individual testimony could be assessed using a non-reductionist approach, it is not entirely clear that the non-reductionist approach could be applied to collective scientific knowledge. I argued that

in using a method similar to Longino's critical contextual empiricism, the reliability of the content of testimony of the collective could be determined at least to some degree. However, one concern with using a non-reductionist approach to testimonial justification of collective scientific knowledge, is that it may not be possible for defeaters to be brought forward. Another concern with using the non-reductionist approach to collective scientific knowledge, is that in collective scientific knowledge there are two instances of testimony and the collective's testimony relies on the individual testimony within that collective. If the collective uses unjustified testimony, then the error from the individual's testimony could be passed on in the testimony of the collective. In the non-reductionist approach the only other requirement for testimonial justification other than reliability of the testifier is that there are no defeaters. If none of those defeaters address the issue of potentially unreliable testimony within the collective, then there is nothing checking the impact of the individual testimony within the collective on the collective's testimony. Further, the impact of the individual testimony within the collective would need to be worked into the assessment of the reliability of the collective or an additional condition would be required in the non-reductionist approach that considers the impact of unjustified testimony within the collective. Given that the non-reductionist approach does not seem to work with collective scientific knowledge, I will now move on to considering the reductionist approach.

4.2 Collective Scientific Knowledge and Reductionism

A reductionist approach, global or local, would rest solely on the non-testimonial positive reasons the recipient uses to assess the reliability of the testimony. Chapter One showed

that there is a social element to science and Chapter Two presented arguments for collective scientific knowledge. In both social and collective scientific knowledge testimony is used in some form. This means social and collective scientific knowledge is incompatible with a global reductionist approach. Recall from Chapter Three that a global reductionist approach reduces all instances of testimony to non-testimonial positive reasons for testimonial justification.[14] That is, in order for a recipient to be justified in acquiring knowledge based on the word of a testifier, the recipient must have non-testimonial positive reasons for believing the testimony is reliable. Given the scope and experience necessary to confirm the reliability of scientific knowledge, it is improbable, if not impossible, for the recipient to accomplish this without using testimony of some sort. This becomes apparent when we recall the discussion about the social nature of science. When it comes to collective scientific knowledge, it is only through the cooperation of multiple subjects that the knowledge is produced. This cooperation at some point includes relying on the knowledge and therefore testimony of fellow members of the collective. Thus, a global reductionist approach will not work.

It is possible that a form of a local reductionism may work and Deborah Tollefsen argues for this point in their paper "Group Testimony".[15] Tollefsen argues for a modified form of a local reductionist approach to group testimonial justification. For Tollefsen, reduction to a non-testimonial source of justification for testimonial beliefs in general is impossible.[16] Tollefsen instead follows Elizabeth Fricker in using independent reasons for testimonial

14. Lackey, "It Takes Two to Tango," 161.

15. Deborah Tollefsen, "Group Testimony," doi: 10.1080/02691720701674163, *Social Epistemology* 21, no. 3 (July 2007): 299–311, http://dx.doi.org/10.1080/02691720701674163.

16. Ibid., 304.

justification in particular instances.[17] Tollefsen argues that there are mechanisms in place to monitor the groups that are giving testimony as well as the testimony put forward by these groups.[18]

Tollefsen extends Fricker's notion of monitoring the trustworthiness of the testifier and testimony in question from use in individuals to use in groups.[19] One of the ways to monitor the trustworthiness of groups relies on assessment of the nature of the group dynamics and functioning. Looking at how the individuals interact with each other along with the goals, interests, and purposes of the group is likely to give an indication of the trustworthiness of the group as a whole.[20] Similar to the approach of monitoring individuals for signs of dishonesty, groups can also be monitored as a whole for dishonesty. It is also possible to highlight biases related to the interest or goals of the group.[21] In fact, it is likely that certain groups were formed because they have a similar goal or interest that they wish to promote. It is also possible that sometimes the interests and goals of the group do not align or inform the interests or goals of the individuals within the group. Therefore, it is not really necessary to reduce the group to its individuals when considering assessments of group trustworthiness. It is further possible to look at the history of the group to determine trustworthiness.[22] In this case, if a group is inconsistent with its response to similar situations, there is an indicator that the group is less trustworthy with regard to those particular issues. Thus, for Tollefsen, it is more important that the group as a whole

17. Tollefsen, "Group Testimony," 304.
18. Ibid., 304-308.
19. Ibid.
20. Ibid., 306.
21. Ibid.
22. Ibid.

be monitored for trustworthiness and consistency versus relying on the trustworthiness and consistency of the individuals who compose the group in question.

Tollefsen also argues that background beliefs can be used to assess the testimony of groups.[23] According to Tollefsen, a recipient may be able to use their background information in order to make an assessment of the group testimony.[24] These background assumptions may not necessarily relate directly to the piece of information being testified to by the group but instead lend support or opposition to the testimony of the group in question. For instance, the recipient may have reports from other sources that report the same or different information related to the testimony in question. The recipient could use this information to assess if the testimony of the group is consistent or not with the other sources of information. Tollefsen also notes that in some cases, it is background information about the domain or process of the group in question that indicates if the group in question is credible or not.[25] For example, knowing that scientific journal articles are reviewed by peers with sufficient knowledge to critique the article helps a recipient assess the likelihood that the information presented in a journal article by a group would have undergone some sort of critical evaluation before being made public. It is also possible to assess group testimony using just general background information.[26] For example, if a group argues that fairies helped me write this thesis then this testimony can be compared to background information one has about the existence of fairies, the nature of writing a thesis on a laptop, the fact that people at coffee shops have seen me writing on my

23. Tollefsen, "Group Testimony," 307-308.
24. Ibid., 307.
25. Ibid., 308.
26. Ibid.

laptop and not a fairy, and so forth. Consideration of situation, scope, and circumstances surrounding the testimony of not only individuals but groups can help a recipient assess the information provided in the testimony.

I would extend Tollefsen's theory to include an additional kind of assessment where the information presented by the group is 'checked'. This seems like a technique already used in some scientific endeavours. By this I mean that when an individual or group comes up with a piece of information it is then used as if it were true in further tests or experiments. If these new tests fail, then it is possible that the testimony given was not accurate and therefore, should not be classified as knowledge. On the other hand, if the information in the testimony leads to improvements then this may allow the recipient to make judgements regarding the information provided by the group testimony.

Using both background information and future tests does not necessarily require that the testimony of the group be reduced to the individuals. In this case, it is the information provided by the group that is being tested not the beliefs or knowledge of the individuals that comprise the group. Further, it is possible to see how the individuals in the group may not even agree with the information provided by the testimony of the group but nonthe-less the group testimony could still be assessed on the information that is provided by the group. This becomes particularly important in the 'checking' case where a group can testify that some information is accurate in order for their information to be checked by others.

Tollefsen presents this argument for a local reductionist approach to testimonial justification but there are some concerns with this approach. Again, the question of the two kinds of testimony is not addressed in Tollefsen's approach. Tollefsen gives an argument

for assessing the testimony of the group or collective but does not discuss the testimony that is in use within the group. Considering that Tollefsen is extending a local reductionist approach to individual testimony, it seems likely that this is how the testimony of the individuals within the collaborative could be assessed. In this way, there could be a continuity of local reductionism. An assessment of the testimony at the collective level and an assessment of the testimony at the individual level. The question, however, is what happens when it is not clear what the testimony of the individuals within the collective is. In what way would the knowledge need to be presented so that both kinds of testimony can be assessed? In this case, the knowledge production process within the collective may become important and possibly enough to confirm that the collective is satisfied with the justification for the testimony of the individuals within the collective.

Another concern is what happens when a conflict arises between assessment of the two cases of local testimony. Particularly what happens if the local testimony of an individual within the collective is considered unjustified but the local testimony of the collective is considered justified. For example, say a collective of individuals is looking for a link between gene A and eye color in various animals. The collective sets out a reliable method for determining the gene and eye color of the various animals. However, in order to make the data collection easier, various scientists are hired and each is given a group of animals to observe. At the collective level, this experiment is reliable in that it has a reliable method that all the scientist adhere to. As long as positive reasons exist for the reliability of the testimony of the collective in this particular instance, there is no need to provide additional positive reasons to believe that each scientists did in fact adhere to the method in question. So, according to the local reductionist approach, knowledge based on the testimony of this

collective of scientists' experiment would be justified. Now say that one of the scientists mistakenly includes animals with either gene A or gene B because they did not use an appropriate method for determining which animals had gene A. When we look at the local testimony of that scientist, we would say that their testimony is not reliable in this case. However, we have already determined that the knowledge provided by the collective this scientist belongs to is justified. So, if it is the case that the collective's knowledge is based on incorrect data from the testimony of an unjustified source, it would make sense that this would undermine the reliability of the collective's testimony.

In this section I argued that collective scientific knowledge and global reductionism are by definition incompatible. According to global reductionism all instances of testimony ultimately rest on non-testimonial positive reasons. Since irreducibly collective scientific knowledge argues that it is only the collective that holds the knowledge in these instances and not the individual, the collective must rely on some form of testimonial knowledge. Given that a global reductionist approach will not work with collective scientific knowledge, I moved on to discussing the possibility of a local reductionist approach by considering one provided by Deborah Tollefsen. I discovered that Tollefsen was able to provide an argument for the possibility of providing independent positive reasons for monitoring the trustworthiness and therefore, reliability of a collective. This monitoring included consideration of group dynamics and functioning, the appearance of dishonesty, the goals and interests of the group, the background assumptions and beliefs used, and the context, situation, and history of the group. The results of this monitoring would provide the positive reasons to support the testimony in question. I further added the argument that a mechanism of 'checking' could be used to provide positive reasons for supporting the testimony. So,

there is an argument to be made for the possibility of a local reductionist approach to the testimonial justification of collective scientific knowledge but this local reductionist approach said nothing about the testimony of the individuals within the collective and if this testimony needs to be assessed as well. Further, there was no consideration of whether the unjustified testimony of an individual within the collective could undermine the testimony of the collective. Again, it appears an additional requirement is needed in order to account for the interaction between the testimony of the individuals within the collective and the testimony of the collective. Since, the reductionist approach to testimonial justification was not sufficient either, I will move on to considering the dualist approach.

4.3 Collective Scientific Knowledge and Dualism

As described in Chapter Three, Lackey claims that in order to have a better theory of testimony elements of both non-reductionism and reductionism are required.[27] Specifically, Lackey requires the reliability or truth conducive element from non-reductionism, the positive reasons element from reductionism, and adds the condition that the knowledge must also be based on the content of the testimony.[28] This dualism may help explain the authority associated with scientific knowledge because of the extensive requirements that need to be met in order for the label scientific knowledge to be conferred. However, social and collective scientific knowledge depend on testimonial reasons for its production, particularly in the case of irreducibly collective knowledge. How is it possible to have both non-testimonial reasons and testimonial reasons for the justification of testimony of social

27. Lackey, "It Takes Two to Tango," 170.
28. Ibid.

or collective scientific knowledge?

Taking only the reliability or truth conducive component and the positive reasons component may be beneficial for considering the possibility of testimonial justification of collective scientific knowledge. The way that Lackey has specifically defined dualism is individualistic but dualism does seem expandable to collectives.

For collective scientific knowledge to meet the the requirements of dualism, it would first need to be based on the content of the testimony. In Chapter Two the possibility of knowledge being produced by a collective was addressed. There were a few options for production of knowledge that could be considered distinctly collective in nature. Cheon clarified that collective knowledge could be seen as jointly committed knowledge or irreducibly collective knowledge depending on why the knowledge was considered collective.[29] Either way, the product of both of these kinds of collective knowledge is still knowledge content. Thus, it is possible for the content condition of dualism to be satisfied.

As we saw in the discussion of collective scientific knowledge and non-reductionism, it could be difficult for a recipient to assess the reliability or truth conductivity with regards to the testimony of collective scientific knowledge. However, it may be possible if the knowledge is produced by a particularly critical process like critical contextual empiricism. At the very least, the reliability of the knowledge could be assessed to some degree. It is less clear if there is a possibility of truth conductivity in collective scientific knowledge but Rolin's argument for jointly committed knowledge does rely on a shared goal of truth. It was also unclear whether unjustified testimony of an individual could undermine the testimonial justification of the collective's knowledge. However, when it comes to dualism,

29. Cheon, "In What Sense."

it may not be as much of an issue that the testimony of the individual is left unassessed or unjustified. As the discussion in Chapter Two on collective scientific knowledge noted, a consensus within a collective or disagreement within a collective by individuals is not necessary for the theories on collective knowledge to exist in a form like jointly committed knowledge. However, unjustified individual testimony may still be an issue if the knowledge is irreducibly collective scientific knowledge. In the end, it is possible that some form of collective knowledge could satisfy condition two. Time to consider the third condition for dualism.

In dualism, positive reasons also need to be present in order for there to be testimonial justification. In an individual context, this means that the recipient must have positive reasons for accepting the testimony of the testifier.[30] Extending this to collective scientific knowledge would require the recipient, be it a collective or individual, to have positive reasons for accepting the testimony of the collective. The discussion of Tollefsen's theory of group testimony demonstrates that positive reasons can be given in support of testimony that is from a group of individuals. Tollefsen's method involves using the same methods that are used to assess the trustworthiness of individuals in order to assess the trustworthiness of groups.[31] Tollefsen also argues that group dishonesty and background assumptions could be assessed in the same way that individual dishonesty and background assumptions could be assessed.[32] For dualism, this means that positive reasons can be given for collective scientific knowledge. Whether it is jointly committed knowledge or irreducibly collective knowledge, positive reasons can be given in support of the testimony. Further, the issue of

30. Lackey, "It Takes Two to Tango," 170.
31. Tollefsen, "Group Testimony," 304-308.
32. Ibid.

whether the testimony of the individuals within the collective needs to be assessed has less of an impact on the condition for positive reasons. For dualism, the focus seems to be on the positive reasons for the collective's knowledge and not the knowledge of the individuals that make up the collective. So, since the third condition can also be satisfied, it seems possible that dualism is compatible with collective scientific knowledge.

The concern that there is no accounting for the interaction of the two kinds of testimony in collective scientific knowledge again becomes an issue. An argument could be made for the testimony of the collective scientific knowledge being compatible with dualism. An argument could also be made for the testimony within the collective scientific knowledge being compatible with dualism. However, there is little instruction on what happens when one instance satisfies the conditions for dualism but the other does not. I am particularly concerned with what happens when the individuals within the collective do not meet the requirements for dualism. Is one of the positive reasons necessary for dualism in collective scientific knowledge that we know that the testimony of the individuals is justified? Is the reliability or truth-conductivity of the collective undermined if the testimony of the individuals within the collective is unknown or unjustified? Unfortunately, these issues mean that in its current state dualism is also insufficient for providing an argument for the testimonial justification of collective scientific knowledge.

In this section I considered the dualist approach to testimonial justification presented by Jennifer Lackey. I argued that collective scientific knowledge can meet the requirements for dualism by discussing the possibility of the collective satisfying the conditions for dualism. I showed that it is possible for collective scientific knowledge to present testimonial content, that the reliability or truth conductivity of the collective can be assessed, and that positive

reasons can be given in support of the collective's testimony. However, there is still no way to consider the impact of the interaction between the two instances of testimony in collective scientific knowledge. I therefore concluded that even the dualist approach needs more in order to provide an account of testimonial justification for collective scientific knowledge.

Conclusion

In this thesis, I consider whether current theories on testimonial justification can be applied to testimony of collective scientific knowledge. This analysis is presented in Chapter Four which considers each approach to testimonial justification in turn. Before explaining my analysis it was first necessary to present some background information.

In the first two sections of Chapter One I discussed why earlier theories like Logical Positivism and Wholism were lacking when it came to explaining scientific knowledge and its production. In the third section of Chapter One, I presented Helen Longino's argument that science should be considered social knowledge. The final two sections of Chapter One presented two theories on social scientific knowledge. The two social scientific knowledge theories that I presented were Helen Longino's critical contextual empiricism and Silvia Tossut's social scientific knowledge. Considering scientific knowledge as social scientific knowledge opened the door to considering some scientific knowledge collective scientific knowledge.

In Chapter Two, I described different kinds of collective scientific knowledge. The first section presented Kristina Rolin's scientific knowledge based on a concept of joint commitment. In Rolin's conception of scientific knowledge, knowledge becomes collective when there is a joint commitment by a collective of individuals to promote and defend the

knowledge as the knowledge of the collective. In this section I also expanded the discussion on jointly committed knowledge by clarifying the use of the burden of proof. In the second section of Chapter Two I discussed Hyundeuk Cheon's distinction between jointly committed knowledge (JCK) and irreducibly collective knowledge (ICK). In order to clarify the distinction, Cheon contrasts Rolin's jointly committed knowledge with K. Brad Wray's irreducibly collective knowledge. Wray's irreducibly collective knowledge is only created through the combined efforts of multiple individuals. For Cheon, the different goals of the two kinds of collective scientific knowledge make them distinct. This distinction becomes important when it comes to criticism of the knowledge in question because it becomes unfair to criticize JCK as if it were ICK and vice versa. In the final section of Chapter Two, I discussed Jeroen de Ridder's irreducibly collective scientific knowledge based on satisfaction of the justification condition for scientific knowledge. In de Ridder's irreducibly collective knowledge, the knowledge is considered collective when the individuals within the collective depend on each other epistemically in order to justify the knowledge. When scientific knowledge is only justified at the collective level, it can only be collective scientific knowledge. Once the theories on collective scientific knowledge were presented, I moved on to explanation of testimonial justification.

In Chapter Three, I discussed three approaches to testimonial justification. I discussed the non-reductionist approach, the reductionist approach, and the dualist approach. In the first section I discussed the non-reductionist approach in which knowledge gained through testimony is justified when the knowledge is reliably produced and the recipient has no defeating reasons for accepting the testimony. This approach focuses on the testifier and whether there is reason to doubt the testimony. Instead of focusing on the testifier, the

reductionist approach focuses on the recipient and if the recipient has positive reasons for accepting the testimony. In the second section of Chapter Three, I discussed the global reductionist approach and the local reductionist approach. The global reductionist approach focuses on all testimony being reducible to non-testimonial positive reasons. The local reductionist approach on the other hand focuses on only particular instances of testimony and if those instances are reducible to non-testimonial positive reasons. In the third section of Chapter Three, I discussed Jennifer Lackey's dualism. In dualism, testimony is justified if the testimony is based on content that is reliable or truth conductive and there are non-testimonial positive reasons for accepting the testimony. Dualism pulls elements from both non-reductionism and reductionism in the hopes of avoiding the concern that both non-reductionism and reductionism are too one-sided in their focus and therefore not rigorous enough. Chapter Three ended the background information necessary for understanding my concern.

In Chapter Four, I discussed my concern that the approaches to testimonial justification are not currently suitable for assessing the testimony of collective scientific knowledge. In the first section, I argued that the reliability of collective scientific knowledge could be assessed by adapting Longino's critical contextual empiricism but that it may not be possible for defeaters to be considered because this would require the creation of another independent but similarly knowledgable collective. I also argued that there is nothing checking the impact of the individual testimony within the collective on the collective's testimony with the result that errors in individual testimony could be passed on in the collective's testimony. I suggested that the impact of the individual testimony within the collective would need to be worked into the assessment of the reliability of the collective

or that an additional condition would be required that considers the impact of unjustified testimony within the collective. Given these concerns, I concluded that the non-reductionist approach to testimonial justification is not currently adequate for assessing testimonial justification in collective scientific knowledge.

In the second section of Chapter Four, I argued that global reductionism and collective scientific knowledge were by definition incompatible and therefore focused on Deborah Tollefsen's argument for a local reductionist approach. Tollefsen's approach relies on extending the method for monitoring the trustworthiness of individuals to the trustworthiness, and therefore reliability, of groups. The results of this monitoring would then provide the positive reasons to support the testimony in question. I expanded Tollefsen's local reductionism by arguing that a mechanism of 'checking' could also be used to provide positive reasons for supporting the testimony. My analysis found that this local reductionist approach said nothing about the testimony of the individuals within the collective and if this testimony needs to be assessed as well. Further, there was no consideration of whether the unjustified testimony of an individual within the collective could undermine the testimony of the collective. I again suggested that an additional requirement is needed in a local reductionist approach that accounts for the interaction between the testimony of the individuals within the collective and the testimony of the collective. I concluded that the reductionist approach, global or local, is also not currently adequate for assessing testimonial justification in collective scientific knowledge.

In the final section of Chapter Four, I argued that the conditions for Lackey's dualism could be met by collective scientific knowledge. I showed that it was possible for collective scientific knowledge to present testimonial content, that the reliability or truth conductivity

of the collective's testimony could be assessed, and that positive reasons could be given in support of the collective's testimony. However, I also argued that there was still no way to consider the impact of the interaction between the two instances of testimony in collective scientific knowledge. Again, an additional requirement needs to be added to the dualist approach that considers the impact of the individual testimony particularly when the individual testimony is unjustified or when the individual testimony cannot be adequately assessed. I therefore concluded that even the dualist approach is currently not adequate for assessing testimonial justification in collective scientific knowledge.

So, after consideration of everything within this thesis, I am led to the conclusion that current theories on testimonial justification need to be reworked in order to account for the two kinds of testimony found in collective scientific knowledge. An adequate theory of testimonial justification for collective scientific knowledge would help both scientists and non-scientists understand when one could claim to have attained knowledge from a collective scientific endeavour. Further, this may help in determining if the process for producing collective scientific knowledge needs to be changed in order to ensure that it will meet the requirements for testimonial justification. Ultimately, I hope that the considerations in this thesis will encourage more critical thought on when it is acceptable to say you know what you know because a scientist or a group of scientists said so.

Bibliography

Audi, Robert. "Testimony as a Social Foundation of Knowledge" [in en]. *Philosophy and Phenomenological Research* 87, no. 3 (2013): 507–531. http://resolver.scholarsportal.info/resolve/00318205/v87i0003/507%5C_taasfok.

Cheon, Hyundeuk. "In What Sense is Scientific Knowledge Collective Knowledge?" Doi: 10.1177/0048393113486523; 17, *Philosophy of the Social Sciences* 44, no. 4 (July 2014): 407–423. http://dx.doi.org/10.1177/0048393113486523.

de Ridder, Jeroen. "Epistemic Dependence and Collective Scientific Knowledge." *Synthese* 191, no. 1 (January 2014): 37–53.

Feyerabend, Paul K. "Against Method." In *Minnesota Studies in the Philosophy of Science*, edited by Michael Radner and Stephen Winokur, 4:17–130. University of Minnesota Press, 1970.

———. "Explanation, Reduction, and Empiricism." In *Minnesota Studies in the Philosophy of Science*, edited by Herbert Feigl and Grover Maxwell, 3:28–97. University of Minnesota Press, 1962.

Hanson, Norwood Russell. *Patterns of Discovery*. Cambridge University Press, 1958.

Hempel, Carl G. "I.-Studies in the Logic of Confirmation (I.)" [in en]. *Mind* LIV, no. 213 (January 1945): 1–26. http://resolver.scholarsportal.info/resolve/00264423/vlivi213/1%5C_iitloc.

———. "I.-Studies in the Logic of Confirmation (II.)" [in en]. *Mind* LIV, no. 214 (April 1945): 97–121. http://resolver.scholarsportal.info/resolve/00264423/vlivi214/97%5C_iitloc.

———. "Studies in the Logic of Confirmation." In *Aspects of Scientific Explanation*. The Free Press, 1965.

Institute, National Human Genome Research. "An Overview of the Human Genome Project: What was the Human Genome Project?" National Human Genome Research Institute. https://www.genome.gov/12011238/an-overview-of-the-human-genome-project/.

Kuhn, Thomas. "Refletions on my Critics." In *Criticism and the Growth of Knowledge*, edited by Imre Lakatos and Alan Musgrave, 231–278. Cambridge University Press, 1970.

———. *The Structure of Scientific Revolutions, 2nd Ed.* University of Chicago Press, 1970.

———. "Theory Change as Structure Change: Comments on the Sneed Formalism." In *Historical and Philosophical Dimensions of Logic, Methodology, and Philosophy of Science*, edited by Robert Butts and Jaako Hintikka, 289–309. D. Reidel, 1977.

Lackey, Jennifer. "Introduction." In *The Epistemology of Testimony*, edited by Jennifer Lackey and Ernest Sosa. Oxford University Press, 2006.

Lackey, Jennifer. "It Takes Two to Tango: Beyond Reductionism and Non-Reductionism in the Epistemology of Testimony." In *The Epistemology of Testimony*, edited by Jennifer Lackey and Ernest Sosa. Oxford University Press, 2006.

Longino, Helen E. *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*. Princeton University Press, 1990.

———. *The Fate of Knowledge*. Princeton University Press, 2002.

Rolin, Kristina. "Science as Collective Knowledge" [in en]. *Cognitive Systems Research* 9, nos. 1-2 (March 2008): 115–124. http://resolver.scholarsportal.info/resolve/13890417/v9i1-2/115%5C_sack.

Tollefsen, Deborah. "Group Testimony." Doi: 10.1080/02691720701674163, *Social Epistemology* 21, no. 3 (July 2007): 299–311. http://dx.doi.org/10.1080/02691720701674163.

Tossut, Silvia. "Membership and Knowledge: Scientific Research as a Group Activity." *Episteme* 11, no. 3 (September 2014): 349–367.

Wray, K. B. "Who has Scientific Knowledge?" Doi: 10.1080/02691720701674288, *Social Epistemology* 21, no. 3 (July 2007): 337–347. http://dx.doi.org/10.1080/02691720701674288.