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HENRY G. VAN LEEUWEN

THE PROBLEM
OF CERTAINTY IN
ENGLISH THOUGHT
1630-1690

WITH A PREFACE BY
RICHARD H. POPKIN



MARTINUS NIJHOFF

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PREFACE

The revival of ancient Greek scepticism in the 16th and 17th centuries was of the greatest importance in changing the intellectual climate in which modern science developed, and in developing the attitude that we now call "The scientific outlook". Many streams of thought came together contributing to various facets of this crucial development. One of the most fascinating of these is that of "constructive scepticism", the history of one of whose forms is traced in this study by Prof. Van Leeuwen.

The sceptical crisis that arose during the Renaissance and Reformation challenged the fundamental principles of the many areas of man's intellectual world, in philosophy, theology, humane and moral studies, and the sciences. The devastating weapons of classical scepticism were employed to undermine man's confidence in his ability to discover truth in any area whatsoever by use of the human faculties of the senses and reason. These sceptics indicated that there was no area in which human beings could gain any certain knowledge, and that the effort to do so was fruitless, vain, presumptuous, and perhaps even blasphemous. Starting with the writings of Henricus Cornelius Agrippa von Nettesheim (1486-1535) and Michel de Montaigne (1533-92), a thoroughly destructive sceptical movement developed, attacking both the old and the new science, philosophy and theology, and insisting that true and certain knowledge can only be gained by Revelation. Montaigne, using his immense humanistic learning and the powerful weapons of Greek scepticism, undermined the pretensions of *both* the claims to knowledge of the Scholastics and those of the Renaissance naturalists. The Schoolmen relied on our dubious sense information and the unreliable human rational faculties. The "new thinkers" like Copernicus and Paracelsus were no better in Montaigne's view for they were just offering theories that were their own opinions, or those of the

ancients, and had no more claim to truth than any other human opinions. Instead of seeking for true knowledge by human means, Montaigne suggested that we recognize our own ignorance. Then, perhaps, we would realize "Or n'y peut-il avoir des principes aux hommes, si la divinité ne les leur a revelez: de tout le demeurant, et le commencement, et le milieu, et la fin, ce n'est que songe et fumée."

This destructive sceptical attitude towards science, new and old, was reiterated by Montaigne's disciples, Father Pierre Charron and Bishop Jean-Pierre Camus. The latter, in his *Essay sceptique*, mixed together all of Montaigne's complaints and those of Sextus Empiricus against the scientists, and then insisted that natural philosophy was "un abysme confus, & un chaos d'embroüillemens, un labyrithe inextricable."

This anti-scientific sceptical attitude reached its peak in the writings of François de la Mothe LeVayer, (1588–1669), tutor of the Dauphin, and counselor to the King. La Mothe LeVayer had inherited the keys to the sceptical kingdom, and was the official *leader of the Montaignians*. He was an intimate friend of many of the leading figures in the Scientific Revolution, including Hobbes, Gassendi and Mersenne. Yet, when he came to write his essay, "Discours pour montrer que les doutes de la Philosophie Sceptique sont de grand usage dans les sciences," La Mothe LeVayer sought to show that the value of scepticism for the sciences is that it destroys them, and exposes them as vain and useless endeavours. The scientist, realizing this, will turn to Revelation instead as his source of knowledge. God prevents us from knowing the causes of events. We, from our brief view of part of the world, construct foolish theories like atomism. Any theory is actually a form of blasphemy, since it is an attempt to limit God's creative ability to what man can understand. And, since God can, if He so wills, change the secondary causal pattern in the world, any discovery in physics can become false. So, we should realize our ignorance, accept the fact that God wills to limit our knowledge, and then abandon scientific research, and turn to Revelation. Scepticism aids the sciences not by clarifying problems, eliminating errors, etc., but by showing they are useless, hopeless, and fruitless endeavours.

In contrast to this destructive tendency of the dominant sceptics of the Montaignian and humanist traditions, another sceptical movement developed at the same time that was to propose a new role and a new method for the sciences in the quest for knowledge. Starting with the view advanced by the Spanish-Portuguese refugee, Francisco Sanchez, (1551–1623), who taught philosophy and medicine at Toulouse (and

who was apparently Montaigne's cousin), a type of complete epistemological scepticism was coupled with an advocacy of pure empirical scientific research as the only profitable type of inquiry because, fundamentally, nothing can be known about the nature of reality. Sanchez, in his *Quod nihil scitur*, of 1581, applied the traditional sceptical arguments to show that no knowledge, especially in Aristotle's sense, is possible. Our senses and our reason are inadequate to measure and know the real nature of things. So, *per non sequitur*, Sanchez advocated that one should collect information about the particular items of sense experience instead of seeking for true knowledge.

In the early 17th century this view was developed further by Marin Mersenne and Pierre Gassendi, the former in his answer to the "destructive" sceptics, the latter in his quest for a *via media* between scepticism and dogmatism.

Mersenne, in 1625, published a 1,000 page work, *La Verité des sciences contre les sceptiques ou pyrrhoniens*, in which he set forth his new theory of knowledge. The work is a dialogue between a sceptic, an alchemist and a Christian philosopher (presumably Mersenne himself). The sceptic outlines the arguments that appear in Sextus Empiricus' *Outlines of Pyrrhonism*. Mersenne answers these not by establishing that something can be known, or that, in the style of his friend Descartes, there is a criterion of truth that enables us to overturn the sceptical attacks, but by admitting that there is no answer to the sceptical reasonings, but what does it matter? We do not need to establish that there is true knowledge, or that there is a completely reliable criterion of true knowledge, or that our faculties are reliable and accurate, or that we are not dreaming, etc. in order to "know" something and to get along in this world. The last three-fourths of Mersenne's book is a compendium of what in fact is known in mathematics and mathematical physics. This most impressive catalogue is sufficient to force the sceptic to recant his doubts, even though his sceptical arguments have not been answered or disproven. We may have no means of "knowing" what reality is like, or even if there is a real world, but no matter how indefensible or unjustifiable our knowledge is, we have a great deal of knowledge about the phenomenal world and about mathematics, and this enables us, pragmatically, to solve our problems.

In his later works, Mersenne spelled out his position plainly. In response to the question, "Peut-on sçavoir quelque chose de certain dans la Physique, ou dans les Mathematiques?" Mersenne insisted the answer was no. We cannot establish that any of our information in

these areas is true about reality. But, this does not mean that the sciences are doubtful or useless. From them we gain knowledge that we cannot doubt (i.e., we are psychologically forced to accept) about the relations and sequences of phenomena, so that we can predict the course of events. Such knowledge serves as our only guide in this world, until it pleases God to reveal true reality to us.

Pierre Gassendi, in a less polemical form, set forth a similar theory. In his early writings, Gassendi had argued for complete scepticism, using the views of Montaigne and Sextus to reach the negative conclusion that no science is possible, least of all that of Aristotle. The only conclusion is that nothing can be known. Later on, Gassendi tempered his epistemological scepticism by joining to it the constructive conclusion of his friend, Mersenne. In the analysis of knowledge in the *Syntagma philosophicum* Gassendi tried to establish a *via media* between dogmatism and scepticism. The type of absolute knowledge sought by the dogmatic philosophers cannot be found, but at the same time we can find a type of knowledge which we have no reason to doubt, and which suffices to enable us to understand the world. This limited knowledge consists of what is obvious to us, our sense experience, plus certain conclusions drawn from this. We can judge from a cautious and careful examination of sense experience that certain other facts should be true, or might be true. These judgments are either verified by later experience, or by the conformity of experience with the system of judgments. Hence, Gassendi's physical theory, atomism, is "justified" as a system of judgments about experience, and is "verified" by the fact that experience is what one would expect, if atomism were true. This yields what he called a shadow of truth, rather than true knowledge itself. Gassendi made no effort to defend his atomic theory as a true picture of reality, and hence, as a metaphysical system. It was defended as the best predictive hypothesis considering what we "know" from sense experience.

For both Mersenne and Gassendi, the sceptical attack on human knowledge could not be satisfactorily answered, but it could be satisfactorily ignored, by recognizing that certain information was, in fact, indubitable, and that the empirical scientific way of dealing with this information provided adequate ways of handling men's problems. The sceptical problems revealed why the dogmatic philosopher would fail in his quest for certainty about reality but did not show that we could not have a limited certainty about the world of appearance that would be adequate for our needs. Scepticism, instead of issuing in the destructive anti-scientific attitude of a La Mothe Le Vayer, could lead to

a constructive effort to find out more and more about the apparent world, because nothing could be known about the real world. Mersenne and Gassendi accepted the sceptics' arguments as decisive against the dogmatists, those who sought knowledge that could not possibly be false, but they then insisted that this did not cast doubt upon the knowledge that we do possess, even though we cannot show that this knowledge is necessary or certain. The grounds for our knowledge remain open to question, but not the knowledge itself.

The constructive scepticism of Sanchez, Mersenne and Gassendi led to a type of theoretical empiricism and positivism that was probably too complex for the state of science of their day. On the other hand, it led to little of importance in experimental or practical results, and it was overshadowed by the dogmatic metaphysical theory of their great contemporary, René Descartes. Their constructive scepticism was brushed aside, to remain alive mainly in the writings of the anti-Cartesians, especially among the Jesuits. But a new version of constructive scepticism was developing in England, among the theologians and scientists of the Royal Society, and with the scientific success of the Society, its theoretical outlook also triumphed. It is the history of this fascinating and all-important view that Professor Van Leeuwen traces in this book.

The "experimental philosophy" that was to flower in the work of the Royal Society in the last decades of the 17th century, goes back not only to the visions of Francis Bacon, but also to a form of common sense constructive scepticism that issues from the destructive sceptical tendencies of some of the religious debates of the late 16th and early 17th century. In the course of the struggles of the Reformation and Counter-Reformation, each side employed a "machine of war", fashioned from the arsenal of classical scepticism to show that the other side had no basis for the claims to religious knowledge and truth that they were making. The brilliant controversialists trained at the Jesuit College de Clermont were able to confound their Protestant opponents, showing that they had no way of telling with certainty which book is the *Bible*, what the *Bible* says, and what one ought to do about it. The Protestant polemicists in turn showed how dubious the Catholic appeals to tradition and authority were, and that poor fallible man had no way of telling with certainty what the tradition had declared, who the authority was, whether the man who calls himself the Pope was the Pope and was infallible, (until one Protestant arguer contended that the Catholic

Church could have at most one member who was sure of his ground, namely the Pope).

While each side was busily undermining the other, raising the total possibility that nothing could be certain in this area, a form of commonsensical constructive scepticism arose as a way of dealing with the issues. Starting with the quiet scholarly Protestant liberal, Sebastian Castellio (1515-63), in his *De Arte dubitandi*, a view was offered that admitted that fundamentally, or theoretically, it might not be possible to eliminate the doubts posed about the bases of religious knowledge, *but* that there was a way to arrive at a type of assurance that was sufficient for man's purposes, and which was the amount of certainty that the case admitted of. Castellio appealed to the means employed in ordinary affairs to arrive at satisfactory and sufficient answers to problems. Hugo Grotius, in his *De Veritate religionis christianae*, developed this theme further, in showing the fruitlessness and hopelessness of trying to gain absolute certainty in this area, and the need to be "reasonable" in dealing with religious questions.

In England, starting with the now almost forgotten figure, William Chillingworth, in his once famous, *The Religion of Protestants*, a view is set forth that, due to certain basic sceptical difficulties, man is unable to find absolutely certain religious knowledge. However, by employing the standards of common-sense and ordinary life, he can obtain a limited certitude that is true beyond any "reasonable" doubt, and that any "reasonable man" will accept. The postman can deliver the mail without solving the sceptical problems about whether he, the letters, and the recipients exist. So, also, the "reasonable" man can find answers to problems about religion without having to resolve the sceptical crisis.

Prof. Van Leeuwen here traces this commonsensical, partial scepticism, as it develops from its rudimentary formulation in Chillingworth, through its more explicit and detailed statements in the various liberal Anglican theologians of the 17th century, up to Bishop John Wilkins, the founder and source of inspiration of the Royal Society, and the Reverend Joseph Glanvill, one of its early members. Then, Prof. Van Leeuwen shows how this kind of constructive scepticism, which had arisen as a practical means of dealing with the theological controversies, became the prevailing outlook of the Royal Society and the "justification" of its experimental activities and achievements. Through this combination of scepticism about the possibility of attaining to any sort of "infallible certainty" and a practical, commonsensical way of gaining "conditional certainty" that was true "beyond any reasonable"

doubt, the theologians, scientists and philosophers of the Royal Society could separate the hopeless quest for knowledge about the real nature of things, from the extremely successful and rewarding quest for information about nature, history, man and God. From pursuing the latter enterprise, instead of the former, the Royal Society was able to establish the importance of experimental research, and to spawn the philosophy, the so-called British empiricism, that has played so great a role in Western thought ever since.

Prof. Van Leeuwen presents this significant chapter in the history of our intellectual heritage in detail and in depth, and has given us much better insight into this major development in 17th century thought. His work, which started as a doctoral dissertation under my direction at the State University of Iowa, has flowered into a genuinely important contribution to our knowledge of the past. It should cause us to reconsider and rethink many of the generalizations and myths that we have accepted about how "it" all happened, such as how the scientific world emerged from the clutches of religious dogmatism, and how the Baconian wild vision became a serious and vital enterprise that forever changed the world.

The Directors of the International Archives of the History of Ideas are most happy to have the opportunity of presenting the results of Prof. Van Leeuwen's studies. We hope that this will lead others into examining and re-examining some of the crucial but neglected aspects of the history of ideas in the period from the Renaissance to the Enlightenment.

RICHARD H. POPKIN

Claremont, California

March 5, 1963

FOREWORD

The aim of this study is to present an historical account of the solution to a problem concerning the certainty of knowledge developed in England between 1630 and 1690. This inquiry begins with an examination of a theological controversy, showing that its resolution influenced the growth of a non-metaphysical, anti-rationalistic, and moderately skeptical scientific outlook. It is shown that in the theological and scientific movements of the period a deliberate effort was made to avoid both dogmatism with its claim to absolute certainty and skepticism with its denial of the possibility of any knowledge whatever. A detailed account is given of the attempt to develop a theory of knowledge which, albeit moderately skeptical, would justify scientific investigation.

The solution to the problem of certainty arose from a controversy between Catholics and Protestants concerning what beliefs are necessary for salvation. Each side claimed its doctrines to be the necessary ones, and the question then arose by what criterion or rule one could decide with certainty which doctrines were necessary. The Protestant solution to the controversy – its theological merits are not discussed – was that theological problems are to be solved in the same way practical problems of ordinary life are solved by a reasonable person. The assurance of common sense about everyday affairs is made the basis for settlement of perplexities about religion. The view is developed that there are several levels of certainty, ranging from absolute certainty in the case of mathematical and metaphysical principles, to moral certainty in the affairs of commerce, travel, science, and religion, down to mere probability; each level of certainty is to be determined by a particular kind of evidence. It is asserted that an exact proportionality must be maintained between subject matter and evidence. One is to accumulate such evidence as is available and base his degree of

certainty thereupon. The view, in addition to proposing reservation in judgment until all available evidence has been examined, also contains a fundamental skepticism concerning man's knowledge of the nature of the real world.

In connection with the religious controversy the views of two liberal Anglican clergymen, William Chillingworth and John Tillotson, are examined and found to contain a somewhat rudimentary formulation of the theory of certainty. Next, the views of some early members of the Royal Society, John Wilkins and Joseph Glanvill, are investigated to see how the theory initially stated in the religious context was secularized. Following this, an attempt is made to show how the theory was applied by Robert Boyle in the context of bona-fide scientific investigation. The views of Sir Isaac Newton on scientific certainty are also presented, though with the suggestion that they were not original with him but simply a continuation of views stated earlier, and that he is not the person responsible for setting the temperament and method of the Society. Finally, the generalized philosophical version of the theory, as set forth by John Locke in *An Essay Concerning Human Understanding*, is presented. By way of conclusion, David Hume's attempt to undermine the theory is sketched.

It is shown, as a subsidiary thesis, that the view that Francis Bacon is the spiritual father of experimental science with respect to aims and method, though initially plausible, must be rejected as false. Though the early members of the Royal Society emulate his view that knowledge is for the improvement of human life and speak highly of his passion for observation of fact, they reject the view that scientific investigation yields absolute certainty about the real structure of nature. Bacon's views concerning the certainty of scientific knowledge are thus shown to be at odds with those of the more influential of the early members of the Royal Society.

In presenting the views of the several persons named, biographical sketches of varying lengths have been attached. The rule followed in the construction of these accounts is that the length of the sketch is determined by the influence of the person on the movement under consideration – the more important the person, the more detailed the sketch – unless, as in the cases of Boyle, Newton, and Locke, the person can be presumed to be known in other contexts or there is sufficient biographical material readily available.

I would like, at this point, to acknowledge my indebtedness to several persons without whose aid this study would have been neither

initiated nor completed. First, I wish to express my thanks to Professor Richard H. Popkin, now of Harvey Mudd College at Claremont, California, who initially suggested the need for such a study as this and who kindly read, reviewed, and constructively criticized it in its various stages of incompleteness. To Professor Harry M. Bracken, now of the University of Minnesota, I wish to express my thanks for his encouragement at times when the spirit was flagging.

Many of the materials for this study could not have been obtained except through the facilities of the University Library of the State University of Iowa. I would like to express particular gratitude to the Reference Services staff of that library, under the direction of Mrs. Julia Bartling. To Mr. Walter Mann of the Hanover College Library at Hanover, Indiana, I also wish to express my thanks. Special mention should be made of the Hanover College Research Committee for a grant which aided in the preparation of the final typescript.

To Mmes. Irma Kramer and Lois Reese who undertook the project of typing this essay in its several stages I owe a special note of thanks. Finally, but not least, I am indebted to my wife Marie who, with the indulgence of Jacalyn and Martin, helped remove many of the grammatical peculiarities this essay once contained and assisted in the preparation of the final typescript. Any faults it still contains are, of course, my own.

Hanover, Indiana
January, 1963



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CHAPTER I

FRANCIS BACON AND SCIENTIFIC KNOWLEDGE

Of the great scientific figures of early seventeenth century England – Harvey, Gilbert, and Bacon – none was so often referred to by members of the Royal Society for a statement of the aims and method of science as was Bacon. Thomas Sprat, the official historian and apologist for the Society, wrote in 1667 in his *History of the Royal Society* concerning Bacon's foresight: "I shall only mention one great Man, who had the true Imagination of the whole extent of this Enterprise [the new science of the Royal Society], as it is now set on foot; and that is, the Lord Bacon. In whose Books there are every where scatter'd the best arguments that can be produc'd for the defense of Experimental Philosophy; and the best directions, that are needful to promote it."¹

Modern historians too, though they are divided on the exact effect of Bacon's theories on subsequent thought, are generally agreed that his views were influential.² In one crucial respect, however, namely his views on the certainty of knowledge, his ideas were not accepted by the more important of his scientific successors who otherwise looked to him with admiration. Here they followed a different tradition, that of liberal Anglican theology. In this chapter some of Bacon's major views concerning scientific knowledge will be outlined, particular emphasis being placed on his ideas about certainty. It will be argued that though the problem he set out to resolve resembled that encountered by his successors, the solution he proposed was essentially different from theirs, and that consequently it was not Bacon's theory of knowledge which became the basis for empirical science and philosophy in

¹ Thomas Sprat, *The History of the Royal Society*, ed. with notes by Jackson I. Cope and Harold W. Jones (St. Louis, 1958), pp. 34-35. Bracketed phrase is mine. Henceforth, unless otherwise noted, bracketed phrases are mine and are added for clarification.

² Kuno Fischer, *Francis Bacon of Verulam* (London, 1857), pp. 468-469; Robert K. Merton, "Science, Technology and Society in Seventeenth Century England," *Osiris* IV (1938), 360-632; Fulton H. Anderson, *The Philosophy of Francis Bacon* (Chicago, 1948), pp. 292-293.

seventeenth century England. In general, it will be shown that Bacon attempted to run a course between the two extremes of uncritical dogmatism and skeptical uncertainty with the intent of achieving absolute certainty about the real structure of nature, and that in this venture he was unsuccessful. He claimed that both these extremes could be avoided by providing the mind and senses with prescribed mechanical aids which would yield absolute certainty. The view developed later in the century began with the recognition that absolute certainty is unattainable and skepticism not completely avoidable, but concluded that a moderate degree of certainty could be had by proportioning belief to whatever evidence is available. In particular, the following features of his views will be examined. First, his account of the nature and ideals of scientific knowledge will be presented. Second, the doctrine of the idols of the mind will be formulated as Bacon's version of a contemporary epistemological problem. Third, his proposals for eradication of the idols will be considered, together with an evaluation of the success of the eradication in view of the ideals set out in the first part.

Bacon's *Instauratio Magna* was a work projected but never completed.³ Of its six parts only the first was finished, an English version of which appeared in 1605 as the *Advancement of Learning*.⁴ The second part, the *Novum Organum*, was first published in 1620, though only partially completed.⁵ Of the remaining parts, some did not get beyond the planning stage or that of having a preface written. In spite of its incompleteness, however, there exists enough to give an insight into the structure of Bacon's views concerning the nature and certainty of scientific knowledge. The general purpose of the *Instauratio Magna* was to renew the scientific enterprise which to Bacon seemed to have been decadent since Socrates turned the direction of philosophic inquiry from nature to the affairs of men. To understand nature and make her secrets and forces subservient to the will and needs of mankind seem to have been his primary motives.⁶ His admonition to those who seek

³ The edition to which reference will be made in this chapter is that in James Spedding, Robert L. Ellis, and Douglas D. Heath, *The Works of Francis Bacon, Baron of Verulam, Viscount St. Albans, and Lord High Chancellor of England*, 15 vols. (London, 1861) – cited as *Works* in this chapter.

⁴ The first edition of 1605 bore on its title page the inscription, *The Two Bookes of Francis Bacon, Of the Proficiency and Advancement of Learning, diuine and humane*. It was enlarged and revised, translated into Latin, and published in 1623 as the first part of the *Instauratio Magna* as *De Dignitate et Augmentis Scientiarum*.

⁵ This edition had as its full title, *Novum Organum, sive Indicia Vera de Interpretatione Naturae*, and was published together with the two prefaces to the *Instauratio Magna*.

⁶ Benjamin Farrington, in his *Francis Bacon, Philosopher of Industrial Science* (New York,

knowledge is that they seek it "for the benefit and use of life, and that they perfect and govern it in charity."⁷

Natural philosophy, according to Bacon, is one of three areas of human knowledge, all of which spring from *philosophia prima* which yields the mathematically certain axioms common to all the special areas of learning and clarifies such 'transcendentals' as identity, diversity, possibility, and impossibility. Natural philosophy has both practical and speculative aspects, the one the production of useful effects, the other the search for causes. The social function of knowledge – the sense in which knowledge is power for the invention of conveniences for life – is Bacon's best known theme, one for which, together with his love for collection of facts and emphasis on observation and experimentation, he was idealized by his successors in the Royal Society. There is, however, another theme in his writings, not often emphasized, that is crucially important for present consideration. Before using nature for the improvement of life, the scientist must have knowledge, and the only acceptable knowledge is that of causes.⁸ The objectives of this search for causes are revealed in his comments on astronomy. As so far developed it is not a perfected science since there is lacking "a well-fabricated system, or the physical reasons and foundations for a just theory, that should not only solve phenomena, as almost any ingenious theory may do, but show the substance, motions, and influences of the heavenly bodies, as they really are."⁹ Both the Ptolemaic and Copernican theories are deficient insofar as they are merely alternative ways of organizing observed data which provide no insight into the internal workings of things themselves. Observation and mathematical demonstrations of astronomical phenomena are without value if they do not make known the natural causes of events and lay bare the essential structure of nature itself. This interest in a

1949), develops extensively this aspect of Bacon's philosophy. He argues that from Bacon's teens onward he had as one of his ideals the betterment of life by the scientific "production of effects."

⁷ "Preface" to the *Instauratio Magna*, *Works*, VIII, 36. The same theme concerning the importance of invention to human life occurs often, e.g., in *Valerius Terminus of the Interpretation of Nature*, *Works*, VI, 33–34, in the *Advancement of Learning*, *Works*, VI, 134–135, and in the *Novum Organum*, *Works*, VIII, 162–163.

⁸ *Novum Organum*, Bk. I, Aphorisms 2–3, *Works*, VIII, 168–169. In the *Scaling Ladder of the Intellect*; or, *Thread of the Labyrinth*, which was to have been the fourth part of the *Instauratio Magna*, but of which only a prefatory outline was written, he writes: "For it is not reasonable to allege, that the true knowledge of anything is to be attained before the mind has a correct conception of its causes." This outline is not contained in the *Works*, but is in Basil Montagu, *The Works of Francis Bacon, Lord Chancellor of England*, 3 vols. (Philadelphia, 1859), III, 519–520.

⁹ *De Augmentis Scientiarum*, *Works*, VIII, 487; see also the *Advancement of Learning*, *Works*, VI, 234.

demonstrative science of causes, as we shall see when considering such men as Joseph Glanvill and Robert Boyle, gets laid aside in favor of a non-demonstrative account of observed phenomena. It is also worth noting that one of his immediate contemporaries, the French mathematician and philosopher, Marin Mersenne (1588–1648), took exception to Bacon's ideal on the ground that the senses, on which scientific knowledge depends, are unequal to the task of penetrating to the real nature of things. He writes in his *La Verité des Sciences*:

Or quelques Phenomenes qu'on puisse proposer dans la Philosophie, il ne faut pas penser que nous puissions pénétrer la nature des indiuidus ni ce que se passe interieurement dans iceus, car nos sens, sans lesquels l'entendement ne peut rien conoître, ne voyent que ce qui est exterior, qu'on anatomise, & qu'on dissolue les corps tant qu'on voudra soit par la fau, par l'eau, ou par la force de l'èsprit, iamais nous n'arriueront à ce point que de rendre notre intellect pareil à la nature des choses; c'est pourquoy ie croy que la dessein de Verulamius est impossible, & que ces instructions ne seront causes d'autre chose que de quelques nouuelles experiences, lesquelles on pourra facilement expliquer par la Philosophie ordinaire.¹⁰

The causes sought for in speculative physics are the traditional ones of Aristotelian science, though they are handled differently by Bacon. The old forms of speech are retained but are given different meanings. The search for material and efficient causes is the domain of physics proper; the search for final and formal causes is the domain of metaphysics, as he uses the term. The difference between the two types of inquiry can be formulated as follows. Knowledge of physical causes enables one to predict and deal with matters similar to those already examined. Knowledge of metaphysical causes, however, enables one to impose a form or nature upon a material which did not previously exhibit it, thus enabling one to transform natural objects according to one's own wishes or interests.¹¹ Since material and efficient causes are not fixed and constant (that is, one cannot make deductions from them) Bacon does not treat them extensively. Final causes are a legitimate subject of inquiry so long as excluded from the study of nature, thus leaving only formal causes for the scientist's investigation.¹² Some authors have argued that formal causes are not discoverable but in this,

¹⁰ Marin Mersenne, *La Verité des Sciences. Contre les Sceptiques ou Pyrrhoniens* (Paris, 1625), pp. 212–213.

¹¹ *De Augmentis Scientiarum, Works*, VIII, 508. In the *Novum Organum* he writes: "Nor again is there any reason to be alarmed at the subtlety of the investigation, as if it could not be disentangled; on the contrary, the nearer it approaches to simple natures, the easier and plainer will everything become; the business being transferred from the complicated to the simple; from the incommensurable to the commensurable; from surds to rational quantities; from the infinite and vague to the finite and certain; as in the case of the letters of the alphabet ..." (Bk. II, Aphorism 8, *Works*, VIII, 177).

¹² *Advancement of Learning, Works*, VI, 223.

says Bacon, they are mistaken because their method is defective. A new method is needed.

The search for the formal causes of particular substances is to be put aside as too difficult; before they can be discovered the formal causes of simpler natures must be unearthed. In the *De Augmentis Scientiarum* he says:

to inquire the form of a lion, of an oak, of gold, nay even of water or air, is a vain pursuit; but to inquire the form of dense, rare, hot, cold, heavy, light, tangible, pneumatic, volatile, fixed, and the like ... which (like the letters of the alphabet) are not many and yet make up and sustain the essences and forms of all substances ... constitutes and defines that part of Metaphysic of which we are now inquiring.¹³

The justification for the search for the forms of simple natures or qualities is that it reduces the multiplicity of observed nature to a small number of simple laws and unleashes new power over nature. By simple form Bacon means those simple laws and regularities which constitute such simple natures, (i.e., qualities) as light, heat, and weight.¹⁴ These laws are such that whenever one of the natures is present, e.g., heat, a certain set of laws, e.g., of motion, is applicable to the situation, and whenever the laws are applicable the nature is present. The relation between presence of the nature and the applicability of the laws is invariable. Whenever the laws apply one can deduce the presence of the nature. Anything less than such knowledge deduced from forms does not qualify as knowledge of nature. Thus for Bacon scientific knowledge is demonstrative and is absolutely certain, a theme which in the sequel we shall see to be unacceptable to the leading members of the Royal Society. Further, since a mechanical method (as will be shown below) can be provided for the discovery of forms, no extraordinary genius is required of the scientist and certainty of the result is assured.

The role of the idols of the mind can be best understood by examining them in the context of Bacon's views on the state of learning, particularly his account of the major tendencies of the history of thought with regard to outlook and method which are relevant to his own times. In the opening paragraph of the preface to the *Novum Organum* he structures three views:

Those who have taken upon them to lay down the law of nature as a thing already searched out and understood, whether they have spoken in simple assurance or professional affectation, have therein done philosophy and the sciences great injury. For as they have

¹³ *Works*, VIII, 505-506; see also *Advancement of Learning*, *Works*, VI, 220.

¹⁴ *Novum Organum*, Bk. II, Aphorism 17, *Works*, VIII, 206.

been successful in inducing belief, so they have been effective in quenching and stopping inquiry; and have done more harm by spoiling and putting an end to other men's efforts than good by their own. Those on the other hand who have taken a contrary course, and asserted that absolutely nothing can be known, – whether it were from hatred of the ancient sophists, or from uncertainty and fluctuation of mind, or even from a kind of fulness of learning, that they fell upon this opinion, – have certainly advanced reasons for it that are not to be despised; but yet they have neither started from true principles nor rested in the just conclusion, zeal and affectation having carried them much too far. The more ancient of the Greeks (whose writings are lost) took up with better judgment a position between these two extremes, – between the presumption of pronouncing on everything, and the despair of comprehending anything; and though frequently and bitterly complaining of the difficulty of inquiry and the obscurity of things, and like impatient horses champing the bit, they did not the less follow up their object and engage with Nature; thinking (it seems) this very question, – viz. whether or not anything can be known, – was to be settled not by arguing, but by trying. And yet they too, trusting entirely to the force of their understanding, applied no rule, but made everything turn upon hard thinking and perpetual working and exercise of the mind.¹⁵

Bacon recognizes here three attitudes toward knowledge of nature. The first is the temperament of the dogmatist who refuses to extend investigation any further on the ground that all truth is already a possession and nothing new remains to be discovered. The second and antithetical temperament is that of the skeptic who, insisting that “nothing can be known,” refuses to make any attempt to understand the world because of its fruitlessness. Finally, there is the mediating attitude of those of “better judgment” who, attempting to avoid both dogmatism and scepticism and believing that knowledge is possible, make an attempt to learn what is open to human scrutiny. Analogues of these three views turn up in other writers we shall consider later, William Chillingworth and John Tillotson, for example, but for them the path of “better judgment” turns out to be different than for Bacon.

Of the attitudes outlined at the beginning of the *Novum Organum*, Bacon of course prefers to align himself with the third. He is deeply disturbed by the abject condition of science in his own time. He laments not so much the actual lack of great inventions for the convenience of life as he does that the scientific enterprise is not geared to produce any.¹⁶ The failure is one of method, in the view either that all has been learned or that nothing can be learned that will be of value. Since neither those who “presume to dogmatize” nor those who “despair of knowing” have anything constructive to offer, their positions must be done away with. This is the burden of the famous doctrine of the idols, of which Bacon writes in the *De Augmentis Scientiarum* that

¹⁵ *Ibid.*, pp. 59–60.

¹⁶ *Ibid.*, Bk. I, Aphorism 73, *Works*, VIII, 104–105.

they "are the deepest fallacies of the human mind. For they do not deceive in particulars ... but by a corrupt and ill-ordered predisposition of mind, which as it were perverts and infects all the anticipations of the intellect."¹⁷

The doctrine of the idols is an early version of a dilemma facing the seventeenth century man of science. The idols are Bacon's account of the impediments to knowledge, his statement of hindrances to certainty. To be more precise, he formulates two extremes: uncritical dogmatism as represented in the idols of the theater, and radical skepticism as represented in the idols of the tribe, den, and marketplace, each of which must be outflanked. He sees – as Descartes did several years later – that unless the mind is cleared of the obscurity of dogmatic systems and purified of the imperfections which hinder it from seeing truth, the new method will be of no value whatever.¹⁸ Those who have a method, as do the dogmatists, have false systems because of a defective basis, what he calls the syllogistic mode of demonstration. Though himself on the side of the dogmatists in his effort to achieve absolutely certain knowledge of the real structure of nature, he sees the necessity for eschewing hasty generalization, unwarranted presumption, and faulty logical procedures. Those who deny the soundness of any method do so because they are ensnared by the foibles of the understanding; to accept their arguments would lead to an impasse in the search for truth.¹⁹ Thus, the idols must be eradicated if the truth about nature is to be established.

The idols can be classified in more than one way. In the fully developed account of the *Novum Organum* they are four in number and are divided into two groups: the idols of the tribe and den affect the mind from within, those of the marketplace and theater affect it from without. They can also be viewed from the standpoint of eliminability: the eliminable idols of the theater as distinguished from the non-eliminable idols of the tribe, den, and marketplace. With regard to the latter classification, he writes in the "Plan of the Work" that there are three "confutations" necessary: one of the unaided senses and understanding, one of syllogistic demonstration, and one of false systems of

¹⁷ *Works*, IX, 97–98.

¹⁸ *Of the Interpretation of Nature*, in Montagu, II, 543; in the same volume see also, *True Hints on the Interpretation of Nature*, p. 551.

¹⁹ That Bacon was conversant with skeptical arguments is evident from both the *Novum Organum* and his essays, the style of the latter of which was probably derived from Montaigne. The arguments of the ancient Greek skeptics were probably known to him in translation or at second hand; see Louis I. Bredvold, *The Intellectual Milieu of John Dryden: Studies in some Aspects of Seventeenth Century Thought* (Ann Arbor, 1934), especially Chapter II.

philosophy.²⁰ The first of these is aimed at those idols which are innate and not eliminable, the other two at the adventitious idols of the theater. These three refutations, which, strictly speaking, are only compensations for and do not necessarily eradicate the idols, are developed at some length in the *Novum Organum*. Since our interest is in Bacon's general formula for preparing the mind for the new method, we shall confine ourselves to the three refutations.

The systems of philosophy of which the understanding is to be ridded are acquired rather than innate. They can be divided into three groups.²¹ There are, first, those based upon too little information and too few experiments. The founders of such systems seize upon a few commonly known bits of information or opinions without considering their merit or certainty, and upon them construct fantastic structures. Such is the scheme of Aristotle. Second, there are those who, having made a few observations and experiments and noted in them every detail, assume that all areas of knowledge are like that one already studied and begin spinning out theories. These are the empirics; the alchemists and William Gilbert are cited as prominent examples. Finally, there are the superstitious who out of religious zeal make theology and tradition fundamental. Here are found Pythagoras and Plato, and those who try to find all science in the books of Genesis and Job. There are no direct and immediate helps of which one can avail himself to demolish such obstructions to the new philosophy; the only compensation is to understand their weaknesses and the causes thereof so that such systems can be avoided when the true system is established. Some of the signs of weakness Bacon points out are: most of the systems were developed in backward regions in ancient times, they have produced little that is new, some have given up the search for truth, and there is dissension among the several schools.²² Some of the causes of these weaknesses are: relatively little time has been given to the investigation of nature, individual investigators have been pre-occupied with other interests, the goal of inquiry has often been improperly understood, wrong methods have been used, and reverence for antiquity has kept men's attention averted from what is new.²³

²⁰ *Works*, VIII, 45-46. The treatment of the idols in this essay differs from the fourfold classification of the *Novum Organum*; here they are classified as false systems, rules of demonstration, and the unaided human mind. He writes: "And as the first two kinds of idols are hard to eradicate, so idols of this last kind cannot be eradicated at all. All that can be done is to point them out, so that this insidious action of the mind may be marked and reprov'd ..."

²¹ *Novum Organum*, Bk. I, Aphorisms 62-65, *Works*, VIII, 90-94.

²² *Ibid.*, Bk. I, Aphorisms 71-77, *Works*, VIII, 102-109.

²³ *Ibid.*, Bk. I, Aphorisms 78-92, *Works*, VIII, 109-129.

The second refutation is aimed at logical systems; since every system of natural philosophy has as its foundation a system of demonstration, as the latter is excellent or defective so will be the former. Strictly speaking, Bacon admits, he cannot refute another logical system since its logical presuppositions are different from his own. However, he expresses his dissatisfaction with the logic of Aristotle which he regards as the principal culprit:

I on the contrary reject demonstration by syllogism, as acting too confusedly, and letting nature slip out of its hands ... it leaves an opening for deception; which is this. The syllogism consists of propositions; propositions of words; and words are the tokens and signs of notions. Now if the very notions of the mind (which are as the soul of words and the basis of the whole structure) be improperly and over-hastily abstracted from facts, vague, not sufficiently definite, faulty in short in many ways, the whole edifice tumbles. I therefore reject the syllogism; and that not only as regards principles ... but also as regards middle propositions; which, though obtainable no doubt by the syllogism, are, when so obtained, barren of works, remote from practice, and altogether unavailable for the active department of the sciences.²⁴

The mind left to itself considers only a few instances of particulars and from them hastily abstracts a principle regarded as universal, from which in turn deductions are made concerning further particulars not yet encountered in experience. To correct this inclination toward immediate generalization and unwarranted inference, the mind must be fortified with a new method of inquiry, a totally new logic.

The *Novum Organum* is the work in which such a new system of logic, a mechanical help to the mind, is presented. The new method can be schematized as follows. In order to discover a simple form one begins with a list made by observation of particular instances of the presence of the elementary nature (e.g., the quality heat). To this are added other lists, tables of variation and exclusive instances. When the several tables have been tabulated and compared one draws his first conclusion concerning the form in question. This is the "first vintage," and is the first generalization concerning the essence of a nature; this generalization is made after a review of the table of exclusions and provides the genus and some of the differentiae of the essence in question.²⁵ After the first vintage has been drawn further steps are to be taken to complete the induction. At this point however, Bacon's account breaks off and remains incomplete. But the principle involved is evident: to rid the mind of errors in reasoning, the understanding is to be fortified with aids applied externally; if they are properly applied the discovery of formal causes is assured, and so also the highest certainty about the inner structure of nature.

²⁴ "The Plan of the Work," *Works*, VIII, 41.

²⁵ *Novum Organum*, Bk. II, Aphorisms 21-22.

In addition to the perplexities that are produced by language habits that control the order and connection of ideas, the most vicious of the idols are those which are inherent in human nature and consequently cannot be completely eradicated. These are the idols of the tribe and den, the weakness and deceitfulness of the mind and senses which when left to themselves give rise to uncertainty. Bacon's opinion of the unaided faculties is not high:

Then with regard to the first notions of the intellect; there is not one of the impressions taken by the intellect when left to go its own way, but I hold it for suspected, and no way established, until it has submitted to a new trial and a fresh judgment has been thereupon pronounced. And lastly, the information of the sense itself I sift and examine in many ways. For certain it is that the senses deceive ...²⁶

In admitting that the understanding and senses are inherently corrupt Bacon is well aware that he is starting from a position similar to that of those who despair of knowing. However, his conclusions differ from theirs:

We cannot, however, deny, that if there be any fellowship between the ancients and ourselves, it is principally as connected with this species of philosophy [i.e., skepticism]: as we concur in many things which they have judiciously observed and stated about the varying nature of the senses, the weakness of human judgment, and the propriety of withholding or suspending assent; to which we might add innumerable remarks of similar tendency. So that the only difference between them and ourselves is, they affirm 'nothing can be known by any method whatever'; we, that 'nothing can be perfectly known by the methods which mankind have hitherto pursued.' Of this fellowship we are not at all ashamed ...²⁷

Since all the ideas of the mind, exclusive of those derived from divine revelation, are derived from the senses, the refutation of the idols affecting the senses goes hand in hand with the refutation of the other idols; indeed, if the weaknesses of the unaided senses cannot be compensated for, it is difficult to see how, on Bacon's principles, one can adequately compensate for the others. The errors of sense perception are twofold: there are many things which escape them because

²⁶ "The Plan of the Work," *Works*, VIII, 43. In this connection Bacon makes a point in the *Advancement of Learning* which is worth noting for its similarity to an idea later developed by some of his successors we shall study. He points out that one of the deficiencies in the art of judgment is that people fail to note that different kinds of proofs must be related to different kinds of subject matters. He, as did his successors, borrowed this notion from Aristotle, but the kinds of proofs he notes differ somewhat from theirs. He distinguishes the four following kinds of demonstration: immediate consent of the mind or sense, induction, syllogism, and demonstration by congruity or in a circle.

²⁷ *Scaling Ladder of the Intellect; or, Thread of the Labyrinth*. Montagu, III, 519. Concerning the difference between his own position and that of the skeptic he says further: "For, however they may seek, by introducing their distinction of true and probable, to subvert the certainty of science, without at the same time superseding the use or practically affecting the pursuit of it, yet, in destroying the hope of effectually investigating truth, they have cut the very sinews of human industry, and by a promiscuous license of disposition converted what should have been the labour of discovery, into a mere exercise of talent and disputation..."

of such conditions as the medium and distance from the object, and the size, motion, and familiarity of the object; and they are deceptive insofar as they always bear a relation to the self and not to the universe, that is, they are subjectively predisposed.²⁸ Although he insists at one point that the senses discover their own errors, Bacon also admits that they cannot be easily corrected. In the second part of the *Novum Organum* detailed descriptions are given of some of the defects of the senses and of some of the helps to be employed for their compensation.²⁹ In general he confines himself to the faculty of sight. Aid can be given to strengthen, enlarge, and correct vision by using lenses and measuring instruments. For the perception of things beyond the range of vision one can locate the object by means of a bell, or, in the practice of medicine, learn about the interior of the body by such external factors as temperature and condition of the urine. Again, experiments can be devised to keep the senses alert and ready to observe what otherwise would be missed. And so goes the list of aids designed to compensate for deficiencies and shortcomings of the senses. But no mention is made as to what ought to be done to eliminate deceit, the subjectivity of all primitive notions. He says only that it is "corrected by universal reasoning and philosophy."

Whether any of the idols – the systems of philosophy together with the logics upon which they are built and the peculiarities of human nature itself – can be gotten rid of or not, one point is clear: the procedures suggested for compensating for them are generically the same. Together with cautions concerning errors that might occur, the faculties are fortified with aids applied externally. Instruments are to be developed and experiments devised to aid the senses. Precautions are to be taken against the ambiguities of language and the errors of false systems of philosophy. The understanding is to be fortified with experiments and a new method of inquiry to assure the discovery of the forms of simple natures. Although the way is long and arduous, the house of science but slowly built, and certainty often of a lower degree than desired, the way is pointed out. It remains only for the man of science to avail himself of it.

²⁸ "The Plan of the Work," *Works*, VIII, 44; see also *Novum Organum*, Bk. II, Aphorism 40, *Works*, VIII, 273–274.

²⁹ *Works*, VIII, 270–289; see also "The Plan of the Work," *Works*, VIII, 44, where he writes: "I have sought on all sides diligently and faithfully to provide helps for the senses—substitutes to supply its failures, rectifications to correct its errors; and this I endeavour to accomplish not so much by instruments as by experiments. For the subtlety of experiments is far greater than that of the sense itself, even when assisted by exquisite instruments; such experiments, I mean, as are skillfully and artificially devised for the express purpose of determining the point in question..."

How successful is Bacon's proposal for renovation of the mind? The procedure proposed for compensating for the idols, particularly those of the tribe and den, seem inadequate to the severity of the problem involved. He begins with the skeptical admission that these idols are innate, inherent limitations of the senses and understanding. He emphasizes time and again the complexity of nature as compared with the shallowness of the understanding, an admission which by no means reduces the difficulties involved. He seems not to sense the severity of the problems involved, for if the senses and the mind are inherently corrupt a complete renovation from within, as Descartes observed, is needed. It would seem that short of such a complete renovation, the validity of one's results would invariably be vitiated by the insidious action of the idols. One must be on constant guard against deception, but if it is the very nature of the faculties to be deceived, the hope to compensate for deceit is one that by its very nature is unlikely to be fulfilled. From a practical point of view, Bacon's compensations are inadequate to produce the kind of certainty about nature that he regards as ideal, a point his successors in the Royal Society did not fail to see. Indeed, they admitted what he was loath to admit, that the high degree of certainty attending mathematical demonstration was beyond hope of achievement in the sciences.

Bacon is, then, interested in certainty; his method is designed to produce demonstrative certainty of the laws of nature. But he recognizes that before the method can be applied there are certain difficulties which must be overcome, among them the arguments of the skeptics. His interest in these problems is genuine since he recognizes that the difficulties raised constitute a serious challenge to scientific knowledge. The solution he proposes, the application of mechanical aids and the new method, is essentially of the traditional Aristotelian pattern; it is neither adequate to achieve the result he desires nor is it acceptable to his successors. They, as we shall see in the forthcoming chapters, develop what Professor Richard H. Popkin has called "constructive scepticism;"³⁰ they acknowledge that absolute certainty cannot be attained since there is no rational way to overcome the arguments of the skeptics, and propose instead that one should settle for as much certainty as is possible in spite of such arguments.

³⁰ The term "constructive scepticism" is from Richard H. Popkin's *The History of Scepticism from Erasmus to Descartes* (New York, 1961). He classifies Bacon's solution to skepticism as a form of Aristotelianism, and the solution proposed by William Chillingworth, John Tillotson and the early members of the Royal Society is characterized, together with those of Marin Mersenne and Pierre Gassendi, as constructive skepticism.

THE PROBLEM OF CERTAINTY IN ITS THEOLOGICAL CONTEXT

During the seventeenth century English Protestants feared that the Roman Catholic Church was attempting to establish itself as the official Church of the state. Such events as the Gunpowder Plot of 1605, the Popish Plot of 1678, and the attempt of James II to convert Magdalen College, Oxford, into a Jesuit seminary gave rise to and enlivened such suspicions. The conflict was reflected in the numerous books, pamphlets, and broadsides written on every aspect of religion – Church organization, the adequacy of each Church for salvation, attacks on the personality of a particular member of the other Church, the need for a living infallible judge to decide disputes, and the credibility of specific religious doctrines. In one of its phases this dispute was known as the Rule of Faith controversy and concerned the standard or rule which each Church possessed to determine whether its particular doctrines were the ones necessary for salvation. (Later in the century, as we shall see in succeeding chapters, this controversy was secularized and became a dispute concerning the criteria by which any proposition can be accepted as scientifically true). The dispute was, of course, an outgrowth of the Protestant Reformation and was regarded as particularly important in its time because of the high stakes involved: nothing less than eternal life and the adequacy of Catholicism and Protestantism to ensure that end were at issue. Each side to the controversy claimed its doctrines to be the necessary ones and insisted that the logical consequence of the other's position would be no certainty at all in religious matters.¹

¹ For more detail concerning the English controversy see Louis Bredvold, *The Intellectual Milieu of John Dryden*, pp. 73–129. Some features of the controversy as it centered around Chillingworth can be found in Anthony á Wood, *Athenae Oxoniensis*, 3rd ed. with additions by Philip Bliss, 4 vols. (London, 1813), article “Chillingworth,” and in Pierre Des Maizeaux, *An Historical and Critical Account of the Life and Writings of Wm. Chillingworth* (London, 1725), pp. 1–10 and *passim*. For a listing of bibliographies of the controversy see Appendix A in Bredvold's book cited above.

The Protestant solution to the controversy was that theological questions could be solved in the way practical problems of ordinary life are solved by a reasonable person. The assurance of common sense about everyday affairs was made the standard for settlement of perplexities about religion. The view was developed that there are several levels of certainty ranging from absolute certainty to mere probability, each determined by a particular kind of evidence, and that an exact proportion must be maintained between evidence and certainty. On the one hand the admission was made that absolute certainty is an ideal rarely achieved in any area, and never in religion; on the other it was acknowledged that skeptical arguments, if taken too seriously, cannot but lead to the destruction of reasoned religious belief. The strategem devised to solve this dilemma was to accumulate such evidence as is available and base one's belief on it. In this respect a moderate skepticism was developed in that judgment is to be reserved until all available evidence has been examined.

Since the seventeenth century, however, the documents, which are primarily polemical in character, together with the identity of the persons involved in the controversy, have been lost in the oblivion of forgotten history. Therefore, the contributions they made to the beginnings of a new perspective in liberal English Protestant thought and to subsequent developments in the formulation of scientific method in the Royal Society have been largely neglected. In this chapter two of the main characters – William Chillingworth and John Tillotson – and some of the themes of that controversy will be recalled from that oblivion because of their bearing upon the seventeenth century problem of the certainty of human (and specifically religious) knowledge and because of their influence on subsequent developments in the theory of science. The theory initially formulated in the context of religion by Chillingworth and Tillotson was developed and used in the context of science by John Wilkins and Joseph Glanvill, and then by Robert Boyle, Isaac Newton, and John Locke, all influential in scientific and philosophical circles later in the century. It is this theory, rather than that of Bacon, which became the controlling one in the Royal Society.

In the two sections of this chapter the views of Chillingworth and Tillotson will be presented in detail to show how out of a theological controversy there is developed an answer to the philosophical problem of certainty. In Chillingworth the theory receives its initial formulation and in Tillotson, who wrote some twenty-five years later, a formulation is given which is important for its development of detail, its

attempt at definition of crucial phrases, and its conscious use as a weapon against theological opponents. In examining the Rule of Faith controversy and the English Protestant solution to it, we shall not judge the theological merits of either the controversy or the solution to it. To do that would be to go beyond the scope of this study whose aim is to examine only the history of a particular theory in English religious and scientific thought.

SECTION I

WILLIAM CHILLINGWORTH

The life and interests of William Chillingworth were intimately connected with the university at Oxford.² He was born in 1602 of a well-to-do family of the university town, and was made godson to William Laud (1573–1645), who was then fellow of St. John's College and later Archbishop of Canterbury. After two years of study at the university he was made scholar at Trinity College, and in 1620 and 1623 received his B.A. and M.A. degrees, respectively. In 1628 he was made a fellow of his college. As a student he did well; he developed an interest in mathematical studies and in poetry, and is said to have attained a keen skill in dialectics. In 1633 he was ordained and for the merit of his book, *The Religion of Protestants, a Safe Way to Salvation*,³ was promoted to the chancellorship of the Church of Salisbury; in following years he was appointed to some additional positions. In 1640 he was recommended for the degree of doctor of divinity but did not take the degree. When the civil war broke out in 1641 he joined the Royalists, was wounded at the siege of Gloucester, and died soon after in 1643.

His religious life was far more interesting than his ecclesiastical career. Toward the end of the reign of James I (1603–1625) there was an influx of French Jesuits into the country which continued with no opposition from Charles I (1625–1649) because of his affiliation through marriage with the Catholic French crown. Some of these Jesuits settled in and near the university towns where they accosted young divinity students, persuading them to accept the Catholic faith

² For further detail concerning Chillingworth's life see á Wood's *Athenae Oxoniensis*, article "Chillingworth" and Des Maizeaux's biography, both cited in the preceding footnote.

³ William Chillingworth, *The Religion of Protestants, a Safe Way to Salvation* (Oxford, 1638). This book is published in *The Works of W. Chillingworth* (Philadelphia, 1844) – cited in this chapter as *Works*.

and leave the country to study in seminaries on the continent. The situation became so critical that in 1628 Parliament petitioned the King to have all incoming ships searched for Jesuits and outgoing ships searched for their proselytes. King Charles gave instructions that such measures be put into effect, but little came of it. Some of the Jesuits settled near Oxford. One of them, under the alias of John Fisher,⁴ succeeded in convincing Chillingworth to give up the Protestant faith. The issues which motivated Laud's protégé to accept the new faith were the lack of continuity of Protestantism with the early Church and the need for a living infallible judge to decide controversies concerning the fundamental articles of faith.⁵ In 1630 Chillingworth crossed the Channel to attend the English Jesuit college at Douai, a town in northwestern France near the Belgian border, and began a systematic study of the principles of the Catholic faith. His teachers there, seeing in him a potential publicist for the faith, urged him to write for publication his motives for becoming a Catholic. The plan backfired, however, for on taking up his pen he re-examined the issues which had prompted his conversion and came to the conclusion that he had erred in his earlier decision. A series of letters from Laud also influenced him, and in 1631 he returned to Oxford where he resumed his studies. In 1634 he declared himself a Protestant, but did not subscribe to the Thirty-nine Articles until 1638. Even then he accepted them only as principles of peace and unity in the Church and not as containing the doctrines of the Church, since in his estimation some of them were inconsistent with scripture.

Soon after his return to England he became involved in controversies with members of the Catholic Church. To his friend John Lewgar, who had recently left the English Church, he wrote a letter, "Reasons Against Popery,"⁶ in which the questions of infallibility and catholicity of the Church were considered; he also confronted Lewgar in a public debate. A similar controversy occurred with the Jesuit John Floyd (alias Daniel). A third such controversy and public

⁴ Fisher also had an encounter, an unsuccessful one, with Laud. See Volume II, *Conference with Fisher*, of *The Works of the Right Reverend Father in God, William Laud*, 5 vols. (Oxford, 1849).

⁵ In the preface to his main work Chillingworth lists his reasons for change together with the rejoinders which further reflection produced (*Works*, pp. 37-39); see also "An Account of what moved the Author to turn Papist, with his own Confutation of the Arguments that persuaded him thereto," *Works*, pp. 737-740.

⁶ *Works*, pp. 525-529. An account of their public meeting is recorded in "A Conference between Mr. Chillingworth and Mr. Lewgar," *Works*, pp. 686-699.

conference was had with Thomas White, against whose publication, *Rushworth's Dialogues*,⁷ he wrote a brief and critical essay.

These skirmishes were but preparatory to the writing of his major work, *The Religion of Protestants, a Safe Way to Salvation*,⁸ to the writing of which he came accidentally. In 1630 Matthias Wilson, under the alias of Edward Knott, published an essay, *Charity mistaken, with the want whereof Catholics are unjustly charged, for affirming, as they do with Grief, that Protestancy unrepented destroyes salvation*.⁹ This was answered in 1633 by Dr. Christopher Potter, provost of Queen's College, Oxford, in a book whose contents are similarly revealed by its title, *Want of Charitie, justly charged on all such Romanists, as dare (without truth or modesty) affirme, that Protestancie destroyeth Salvation*.¹⁰ Knott replied the following year with *Mercy and Truth, or Charity Maintained by Catholiques*.¹¹ Chillingworth undertook a defense of Potter's book against this reply, but Knott, having managed to secure page proofs before its

⁷ The authorship of *Rushworth's Dialogues. or, the Judgment of common sense in the choyce of Religion* (Paris, 1654) is disputed. In the preface to the third edition of 1654 Thomas White admits writing the Preface and fourth Dialogue, but attributes the first three to William Rushworth. Des Maizeaux (p. 42) claims to have evidence that White is the author of the whole series. The editors of Chillingworth's *Works* follow Des Maizeaux; the editors of the *D. N. B.*, art. "Rushworth," accept White's preface at face value. Chillingworth takes issue with some points of the book (an earlier edition) in an essay, "An answer to some Passages in *Rushworth's Dialogues*, beginning at the Third Dialogue, Sect. xii," (*Works*, pp. 740-758).

⁸ *The Religion of Protestants* was immediately popular. Two editions were published in 1638, one at Oxford and one at London. Subsequent editions appeared in 1664, 1674, 1684, 1687 (condensed edition), 1704, 1719, 1722, and 1742, and other editions in the 19th century. Replies to the work by Roman Catholic writers were immediate and numerous. In 1638 Edward Knott published *Christianity Maintained: or, A Discovery of Sundry Doctrines tending to the Overthrow of the Christian Religion, contained in the Answer to a Book, intituled, Mercy and Truth; or, Charity maintained by Catholiques*, in which he promises an extended book against Chillingworth. The same volume also contains a short essay, "A Reply unto Mr. Chillingworth's Answers to his owne Motives of his Conversion to the Catholique Religion." The Jesuit John Floyd wrote two short books the contents of which are summed up in their titles, *The Church Conquerant over Human Wit; or, The Churches Authority demonstrated by Mr. William Chillingworth (the Proctor for wit against her) his perpetual Contradictions in his Book, intituled, The Religion of Protestants a Safe Way to Salvation, and The Totall Summe, Or No danger of Damnation unto Roman Catholiques for any Errour in Faith: Nor any hope of Salvation for any Sectary whatsoever that doth knowingly oppose the Doctrine of the Roman Church. This is proved by the Confessions and Saying of Mr. Chillingworth his Booke*. In 1639 another attack was made by the Jesuit William Lacy in *The Judgment of an University-Man concerning Mr. William Chillingworth his late Pamphlet, in answer to Charity Maintained*. In the same volume there is a forty-six page essay, "Heautomachia. Mr. Chillingworth against himself." All these attacks were probably published at St. Omer in northwest France. In 1652 there appeared Knott's promised large work, *Infidelity Unmasked; or, the Confutation of a book published by Mr. William Chillingworth, under the title, The Religion of Protestants a Safe Way to Salvation*, which was published at Rheims.

⁹ Edward Knott, *Charity mistaken, with the want whereof Catholics are unjustly charged, for affirming, as they do with Grief, that Protestancy unrepented destroyes salvation* (London, 1630).

¹⁰ Christopher Potter, *Want of Charitie, justly charged on all such Romanists, as dare (without truth or modesty) affirme, that Protestancie destroyeth salvation* (Oxford, 1633).

¹¹ Edward Knott, *Mercy and Truth, or Charity Maintained by Catholiques* (St. Omer, 1634). This book is reproduced in Chillingworth's *Works*.

publication, published a pamphlet in 1636 to prejudice the public against Chillingworth's book. It was in answer to this tract, and to Knott's *Charity Maintained*, and in defense of Potter's work that Chillingworth's book was finally published in 1638.

The main theological issue, as Chillingworth sees the controversy between himself and Knott, is whether Protestants have any assurance of salvation outside the Catholic Church. In the course of arguing that unrepented Protestantism does not destroy the hope of salvation he also argues for a number of subsidiary theses: 1) that men of different opinion concerning the fundamental doctrines of religion, but who are honest and understanding and who give mature consideration to all available evidence, can all be saved; 2) that the means by which the truths necessary for salvation are conveyed to the human mind are the written Scriptures alone; 3) that fundamental points of faith are distinguished by their being evident in the Bible and having been commanded to be preached to all men; and 4) that Protestants are neither heretics nor in schism from the Catholic Church. All these are dependent upon the attempt to show that an oral tradition in addition to the written Scriptures is not required as a rule or standard by which to judge what is necessary for salvation, and that a living infallible judge of what is fundamental is unnecessary and impossible to obtain.

Interwoven among the theological arguments and the polemic of the *Religion of Protestants* are statements and brief discussions which are of interest for their bearing upon the philosophical problem of certainty; though they sometimes occur only incidentally, they function as support for the theological arguments. By bringing these statements together the outlines of a rudimentary theory of certainty can be made out. In formulating Chillingworth's position we shall first state some of its general features, then consider his distinction between knowledge, belief, and opinion, and, finally, present his account of kinds of certainty with their corresponding types of evidence.

Knott had argued that there are but two possibilities with respect to religious knowledge; either absolute certainty of the truths of the faith or none at all.¹² Here, in the religious controversy, are the same

¹² In the second chapter of *Charity Maintained* he writes concerning the canonicity of proposed books of scripture: "But now in deeds, they [Protestants] all make good, that without the church's authority no certainty can be had what scripture is canonical, while they cannot agree in assigning the canon of the holy scripture" (*Works*, p. 90). Further on: "Do they [Protestants] only understand the agreement of the church to be a probable inducement? Probability is no sufficient ground for an infallible assent of faith" (*Works*, p. 91). In commenting on interpretation of the meaning of scripture he writes: "Now, the inconveniences which follow by referring all controversies to scripture alone, are very clear:

two alternatives that had confronted Bacon in his reflections on science. Bacon had hoped to gain absolute certainty (though not dogmatism) by the experimental and inductive method of the *Novum Organum*, and to provide suitable compensation for the idols of the mind. Chillingworth, on the other hand, argues with respect to the first alternative that such certainty is not humanly attainable in religious matters, though possible in mathematics and metaphysics. He is also unwilling to accept the second alternative, rejecting it in favor of the position that there is a modicum of certainty attainable of the doctrines necessary for salvation. In the development of his general position Chillingworth distinguishes between the truth of a statement and the certainty one has it is true.¹³ It may often be the case that a given statement, a doctrine of the Church, for example, is true but that one has insufficient evidence to warrant assenting to it as true. This distinction is particularly applicable in the Rule of Faith controversy where Chillingworth argues that the Scriptures are infallible but that one's "certainty of adherence" to them is not. In the areas of theology, metaphysics, and science, a distinction is drawn between the truth of a principle and the certainty that it has been used correctly in a demonstration.¹⁴ Chillingworth argues that the Scriptures are the perfect rule of faith; however,

for by this principle, all is finally in very deed and truth reduced to the internal private spirit, because there is really no middle way betwixt a public external, and a private internal voice; and whosoever refuseth the one, must of necessity adhere to the other" (*Works*, p. 100). In this section he suggests that dependence upon one's 'private spirit' is to depend upon something variable and uncertain, and thus not productive of truth.

¹³ As will appear later, he argues that the doctrines of the Church are infallibly true, but that believers are required to give only as strong an assent to them as the evidence justifies. See, for example, *Works*, pp. 428 and 476, in the former of which he writes: "to this I answer, that I do heartily acknowledge and believe the articles of our faith to be in themselves truths, as certain and infallible as the very common principles of geometry and metaphysics. But that there is required of us a knowledge of them, and adherence to them, as certain as that of sense or science; that such a certainty is required of us under pain of damnation, so that no man can hope to be in a state of salvation, but he that finds in himself a degree of faith, such a strength of adherence; this I have already demonstrated to be a great error..."

¹⁴ He writes: "So, though the church be not infallibly certain, that in all her definitions, whereof some are about disputable and ambiguous matters, she shall proceed according to her rule, yet being certain of the infallibility of her rule, and that, in this or that thing, she doth manifestly proceed according to it, she may be certain of the truth of some particular decrees, and yet not certain that she shall never decree but what is true" (*Works*, p. 204). It is of interest to note that one hundred years later the same principle was used by David Hume as the basis for an argument against certainty of the kind that Chillingworth was to call demonstrative certainty. In his *A Treatise of Human Nature*, ed. L. A. Selby-Bigge, (Oxford, reprint of 1951), Hume begins his section "Of scepticism with regard to reason," with the observation: "In all the demonstrative sciences the rules are certain and infallible; but when we apply them, our fallible and uncertain faculties are very apt to depart from them, and fall into error" (Bk. I, Pt. iv, Sect. I, p. 180). In every case of reasoning it is necessary to judge whether the rules were applied correctly, then to judge whether the judgment concerning the correctness of application of the rules is correct, and so on *ad infinitum*. Since logically the process terminates only at infinity the original reasoning cannot be known to be correct, thus throwing uncertainty into all demonstrative arguments.

when the rule is used to judge the truth of a proposed doctrine there is no assurance that the rule or standard has been correctly applied. Similarly, even though one knows the axioms of metaphysics and geometry to be true, error can always occur in the deductions made from them. From this viewpoint, the major problem lies in the application of rules and principles, not in the question of their truth; the failure to use rules correctly would preclude absolute certainty.

Given these distinctions and the problems they raise, that is, that one may not always know of a principle which is true that it is so and that error may occur in its application, Chillingworth sets out to determine how much certainty is possible. The positive side of his position is based upon a consideration of kinds of evidence and their attendant degrees of certainty. In assenting to anything intensity of assent must be proportioned to the evidence; to each kind of evidence there corresponds a kind or degree of assent, and as the evidence increases or decreases so does one's certainty.

Depending upon the kind of evidence for a statement one can be said to have knowledge, belief, or opinion of it. Knowledge is first of all to be distinguished from belief, if the words are used in their strictest senses, for "faith [i.e., belief] is not knowledge, no more than three is four, but eminently contained in it, so that he that knows believes, and something more; but he that believes, many times does not know; nay, if he doth barely and merely believe, he doth never know."¹⁵ In the popular sense of the words one is justified in saying, when he believes something attested by evidence, that he knows it. It is generally in this extended sense that the word "know" is used throughout Chillingworth's book. In the second place, "knowledge" (in the strict sense) and "science" are synonymous terms, and whenever they are applicable there is a relation to the object different from that occurring in belief or faith. It is not always the case that a statement is clear and evident to the mind in belief, but for it to be obscure to the mind in knowledge would be a contradiction.¹⁶ Precisely what is meant by the obscurity or clarity of the object known is not, however, made clear by Chillingworth. Another difference between knowledge and belief lies in the manner in which assent occurs. In knowledge one is not free to give or withhold assent, for upon understanding the meanings and connections of the terms of a statement (e.g., in "Whatever God reveals for true is true") one cannot but assent to its truth. In belief, on the

¹⁵ *Works*, p. 428; see also pp. 740-741.

¹⁶ *Ibid.*, p. 428; see also p. 432.

contrary, one may give or withhold assent as he sees fit, depending upon the amount of evidence he thinks necessary to justify belief. Those statements which are known upon understanding the meanings of their terms carry their evidence with them, that is, they are self-evident; those to which assent is voluntarily given have their evidence brought to them via testimony of the senses or of witnesses, and in virtue of the excellence of such testimony assent is either granted or withheld. A further difference between knowledge and belief is that the former does not admit of degrees. One must say that he either knows or does not know the object in question, be it a mathematical axiom or principle of metaphysics; the strength of belief, on the other hand, varies as the evidence is greater or less.

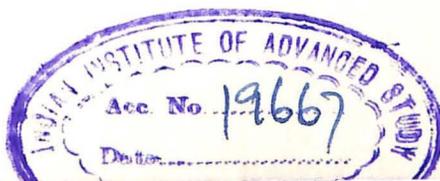
Distinct from knowledge and belief is opinion. Of this little is said except that like belief it involves assent, is based upon a lower degree of evidence than the statements of science and of immediate sense perception, and admits of degrees.¹⁷

In his description of the kinds of certainty a person may have of the truth of a statement Chillingworth is not systematic.¹⁸ In the

¹⁷ *Ibid.*, pp. 80-81.

¹⁸ The theory of levels of assent as presented here was in all likelihood inspired by Hugo Grotius' *The Truth of the Christian Religion* (Paris, 1624). The book was originally intended as a handbook for Dutch sailors, to be used in converting pagans in foreign ports to Christianity and as a basis for their own belief. Although attacked for its anti-Catholicism and as Socinian, the book was widely read and was translated into at least ten languages. Many of the principles on which Chillingworth builds his attack on Knott, as well as specific arguments, have their analogues in Grotius' book. Some of the principles Chillingworth uses are as follows. There is the principle (drawn from Aristotle) that because of differences in the subject matter of mathematics and history, for example, different kinds of proofs are to be used in each. It would be unreasonable for anyone to demand for either discipline the kind of proof appropriate to the other. The different kinds of subject matters for which proofs can be found - ranked from highest to lowest in terms of their respective levels of certainty - are mathematics, natural science, matters of fact and morals, and "doubtful matters." Grotius points out further that the refusal to accept these principles will reduce history, medicine, and morals to mere confusion. He points out particularly that in matters of faith there are no proofs as strong as immediate sense perception or mathematical demonstration, but that such proofs as there are are sufficient to persuade a reasonable person, one who is interested in discovering the truth and is not blinded by passion or prejudice. Finally, again in matters of faith, an appeal is made to common sense in the evaluation of religious testimony: the same canons are to be used in the evaluation of religious as of secular texts - one has as much evidence, and therefore certainty, that what the Bible says about Christ is true, as one does of the life of Socrates from the writings of Plato and Xenophon.

Most of the above points occur in a summary statement Chillingworth quotes from Grotius' book, a part of which is as follows: "... as there are variety of things which be true, so there are divers ways of proving or manifesting the truth. Thus is there one way in mathematics, another in physics, a third in ethics; and, lastly, another kind, when a matter of fact is in question: wherein verily we must rest content with such testimonies as are free from all suspicion of untruth; otherwise, down goes all the frame and use of history, and a great part of the art of Physic, together with all dutifulness that ought to be between parents and children; for matters of practice can no way else be known but by such testimonies, Now it is the pleasure of Almighty God, that those things, which he would have us to believe



main he distinguishes three levels with their subclassifications or degrees: 1) absolutely infallible certainty, 2) conditionally infallible certainty, and 3) moral certainty. The first of these – presumably the kind of certainty Descartes sought in his *Meditations* – Chillingworth regards as beyond human reach.¹⁹ What is required for such certainty is not expressly stated, but by comparison with what he says of the other levels of certainty this would seem to be an assurance based upon such evidence as excludes completely every possibility of doubt, a condition not attainable by mortal man. Conditionally infallible certainty is the highest attainable by man; it is based upon such evidence as excludes, for all human purposes, the possibility of error, but does not exclude it completely. This kind of certainty occurs whenever one has knowledge (in the narrow sense of the term), that is, in those instances in which, upon knowing the meanings and connections of the terms involved, assent is compelled rather than voluntary. Because such mathematical truths as “the whole is greater than any of its parts” and “twice two is four” are of this kind, the certainty one has of their truth is called mathematical certainty; similarly the axioms of metaphysics are said to be metaphysically certain. Such infallible certainty is possible not alone for simple statements of the kinds mentioned but for demonstrations also, an argument being a demonstration when, the premises being proposed and understood, the mind cannot but assent to the conclusion.²⁰

Given this account of some of the features of conditionally infallible certainty and of circumstances in which it can occur, the question can

(so that the very belief thereof may be imputed to us for obedience), should not so evidently appear, as those things which are apprehended by sense, and plain demonstration, but only be so far forth revealed as may beget faith, and a persuasion thereof, in the hearts and minds of such as are not obstinate; that so the gospel may be as a touchstone for trial of men's judgments, whether they be sound or unsound. For seeing these arguments, whereof we have spoken, have induced so many honest, godly, and wise men, to approve of this religion, it is thereby plain enough that the fault of other men's infidelity is not for want of sufficient testimony, but because they would not have that to be had and embraced for truth which is contrary to their wilful desires ...” (*Works*, pp. 477–478). This statement is from Bk. II, Sect. XIX of the *Truth of the Christian Religion*; see John Clarke's trans. (Cambridge, 1860), pp. 90–97.

¹⁹ To my knowledge there is but one reference to absolutely infallible certainty in the *Religion of Protestants* (*Works*, p. 172), and here he points out that a distinction must be drawn between this and conditionally infallible certainty. Since in this discussion he suggests difficulties which attend conditionally infallible certainty, I infer that the hindrances to absolutely infallible certainty must be insurmountable. In most of his discussions reference is made to ‘infallible certainty’ or to ‘absolute certainty’ with no distinctions or qualifications.

²⁰ Chillingworth's view of demonstration is quoted by him from Richard Hooker's *Of the Laws of Ecclesiastical Polity* (1593), Bk. II, Sect. 7, “An argument necessary and demonstrative is such, as, being proposed to any man, and understood, the mind cannot choose but inwardly assent ...” (*Works*, p. 403).

still be raised as to whether it does occur. Chillingworth thinks that it does, but not often. Its occurrence in demonstrations is kept to a minimum by the fact that one can never be sure that the rules of reasoning have been correctly applied; one may know and be certain of his premises but not of conclusions drawn from them.²¹ Again, since one may be deluded by thinking he is awake when actually he is dreaming, what one claims to be certain may be merely a dream.²²

The third kind or classification of certainty is moral certainty, the certainty one has of what is believed but not known. This is the certainty of everyday life about matters of fact and is based on such evidence as for all practical purposes excludes the possibility of error. The certainty one has that when traveling he is on the right road, that when reading a book it is the work of the person whose name appears on the title page, that when a wall aligns with a plumb line it is straight, are of this sort. Moral certainty is described as the certainty a sane, reasonable, thoughtful person has after considering all available evidence as fully and impartially as is possible and giving his assent to that side on which the evidence seems strongest. Since belief is based upon a different kind of evidence than knowledge, and is therefore less certain, the possibility of error is increased. As in conditionally infallible certainty the dream hypothesis prevents absolute certainty from being attained, so in moral certainty a skeptical doubt is also operative, for "seeing the generality of men is made up of particulars, and every particular man may deceive and be deceived, it is not impossible, though exceedingly improbable, that all men should conspire to do so."²³ If this possibility were taken seriously life would soon fall apart. If on grounds of possibility of error alone one refused to accept as credible the testimony of witnesses the trial of criminal cases would soon become a shambles.²⁴ Rejection on similar grounds of the

²¹ *Ibid.*, p. 203.

²² "I ask you again, seeing your eye-sight may deceive you, how can you be sure you see the sun when you do see it? Perhaps you may be in a dream, and perhaps you, and all the men in the world, have been so, when they thought they were awake, and then only awake, when they thought they dreamt" (*Ibid.*, p. 166).

²³ *Ibid.*, pp. 740-741.

²⁴ As an instance of an attempt to defend a witness on the ground of possibility alone one might cite the efforts of the lawyer Fetyukovitch in the murder trial of Dmitri Karamazov in Fyodor Dostoevsky's *The Brothers Karamazov* (Bk. XII, Chs. 2-12). In the course of his defense Fetyukovitch acknowledges that there seems to be a chain of evidence which points conclusively to the guilt of the defendant, but points out that if the links in the chain are examined separately none can stand close scrutiny. The servant Grigory's testimony is challenged on the ground that he may have been drunk when he claims to have seen the defendant in the murdered man's room, and that he cannot conclusively prove that he was even awake at the time. By pointing out that Trifon Borissovitch had kept a hundred roubles

reports of travelers and chroniclers would soon make fiction of history, of the reports of merchants on prices and commodity conditions would soon disrupt the economic world, and of the claims of parents would soon disrupt family relations and morals. Although this possibility exists, it is not destructive of the everyday activities of life; such knowledge as one has of matters of fact – of routes, the reliability of witnesses, and so on – suffices to get one through the day. Since this kind of certainty claims nothing more than to suffice for the affairs of daily life, objections cannot justifiably be brought against it.²⁵ Many things of which one is morally certain may in fact be true, but since such evidence as is available does not warrant a claim to knowledge one need and can be only as certain as the evidence permits.²⁶ Unlike mathematical certainty, moral certainty admits of degrees because the strength of the evidence varies. Precisely where the lines are to be drawn between the several degrees of moral certainty, however, and what the standard is by which the degrees are measured, are not made clear.

In summarizing Chillingworth's account of the certainty which accompanies assent, it can be said that he attempts to show that there are objective factors to which attention must be given, particularly that there is a due proportionality between the evidence for and the certainty one has of a statement. To each kind of object to be known there corresponds a kind of certainty: mathematical certainty where there is mathematical demonstration, and moral certainty where there is credible testimony of a matter of fact, the degree of moral certainty being determined by the excellence of the testimony. The several degrees of certainty are so ranked as to correspond to the several kinds of proofs. From the kind of situation (mathematics or matter of fact) and the kind of proof appropriate to it (demonstration or testimony) one can determine what level of certainty is possible. This is an objective aspect of certainty. To demand stronger evidence than is appropriate (e. g., demonstration of a matter of fact) is to demand

which the defendant had dropped while drunk a month before the murder, the lawyer tries to plant in the mind of the jury the possibility that the testimony he is now giving is dishonest too. He tries to show that since the money which presumably was a motive for the murder has not been accounted for, there is some question whether the motive could have been robbery, much less that robbery even occurred. Finally, he tries to show that even if the defendant had been in the room and had a motive for killing his father, there is still a possibility that he did not do it, that he may have left the room and someone else have come in and committed the crime. The jury, however, is not swayed by Fetyokovitch's eloquence and convicts Dmitri of parricide.

²⁵ *Works*, pp. 203–204; see also p. 221.

²⁶ *Ibid.*, pp. 428–429; see also p. 434.

more certainty than is warranted and would be as unreasonable, says Chillingworth, as to demand of a horse that can go only five miles per hour that it go ten. The justification for rationing certainty in different kinds of situations is both theoretical and practical. The theoretical justification is that some things by their very natures do not admit of more than a specific kind and amount of evidence and therefore it is unreasonable to demand more.²⁷ This is the basis of his criticism of Knott's demand for demonstration (and therefore mathematical certainty) of matters of fact. The practical justification, stated with respect to religious belief, is that moral certainty suffices to give rise to action. Both reasons are expressed in the statement:

God requires not anything but reason ... God is contented if the scale be turned ... God will be satisfied if we receive any degree of light which makes us leave the *works of darkness, and walk as children of the light* ... God desires only that we believe the conclusion, as much as the premises deserve, that the strength of our faith be equal or proportionable to the credibility of the motives to it.²⁸

His views on the subjective aspect of certainty are much less clear, and amount to but an occasional hint. He argues in one place that the certainty of belief is not less than the certainty of knowledge. On the evidence of hearsay, to use his example, one may believe there is such a city as Constantinople. On seeing the city the kind of assent changes but there is no increase in the degree of certainty.²⁹ The certainty, then, of belief can be as great as that of knowledge. This seems to mean that one's feelings are not changed in the two cases; one has no greater propensity to doubt in the one case than in the other. At other places he states that certainty may exceed the evidence there is for it, namely those instances in which God by his grace gives one a greater feeling of assurance than is warranted by the evidence.

Having summarized in a more or less systematic way some of the distinctions and principles employed by Chillingworth, it remains to examine their role in his controversy with Knott. The issue between them concerns the certainty one can have in matters of religion, and finds its expression in the Rule of Faith controversy. Since most of the points made so far have a bearing on this controversy it will be examined in some detail. Knott had argued in *Charity Maintained* that

²⁷ *Ibid.*, pp. 127-128; see also p. 370.

²⁸ *Ibid.*, pp. 114-115.

²⁹ *Ibid.*, pp. 740-741. He writes: "Then, that the testimony of one or two witnesses, though never so credible, could add nothing to that belief which is already at the height; nay, perhaps that my own seeing these cities would make no accension, add no degree to the strength and firmness of my faith concerning this matter, only it would change the kind of my assent, and make me know that which formerly I did believe."

infallible certainty is required, and that to this end there must be a living infallible judge who, with both written and oral scripture at his command, could decide all controversies concerning what beliefs are necessary for salvation. Chillingworth admits that it would be ideal if such certainty were attainable, but claims that since it is not one must be content with less. Controversies about matters of faith are therefore to be decided on the basis of written scripture alone.

Chillingworth argues in the first place that there is no infallible certainty of the infallibility of the Roman Church, and that all Knott's arguments to prove it turn out to be circular:

But yet ... suppose I should for this [deciding which books are canonical] and all other things admit to her direction, how could she assure me that I should not be misled by doing so. She pretends indeed infallibility herein; but how can she assure us she hath it? What, by scripture? That you say cannot assure us of its own infallibility, and therefore not of yours. What, then, by reason? That you say, may deceive in other things, and why not in this? How then will she assure us hereof? By saying so? Of this very affirmation there will remain the same question still, how can it prove itself to be infallibly true? Neither can there be an end of the like multiplied demand, till we rest in something evident of itself, which demonstrates to the world that the church is infallible. And seeing there is no such rock for the infallibility of the church to be settled on, it must of necessity, like the island of Delos, float up and down forever. And yet upon this point, according to papists, all other controversies in faith depend.³⁰

If anything is "evident in itself" it is such that any reasonable and intelligent person will upon inspection accept it as true. Since, however, there are many thoughtful persons who are acquainted with the Roman Church and its principles, but who do not accept it as the only true Church, one can conclude that there is no infallible certainty that it is infallible. And from this it follows that the Roman Church cannot claim a living infallible judge.

Chillingworth's positive religious thesis is that decisions concerning which truths are necessary for salvation are to be based upon scripture alone. This appeal to scripture as the rule of faith can be made only within a certain context, that of belief.³¹ To the non-believer an appeal to scripture to decide his eternal fate or the validity of his beliefs is

³⁰ *Ibid.*, p. 116; see also p. 118 where he replies to Knott's argument that dependence on the Roman Church is better than dependence on human reason. Such dependence would be advisable "if we could be infallibly certain that your church is infallible, that is, if it were either evident of itself, and seen by its own light, or could be reduced unto, and settled upon some principle that is so. But seeing you yourselves do not so much as pretend to enforce us to the belief hereof, by any proofs infallible and convincing; but only to induce us to it by such as are, by your confession, only probable and prudential motives; certainly it will be to very little purpose to put off your uncertainty for the first turn, and to fall upon it at the second; to please yourselves in building your house upon an imaginary rock, when you yourselves see and confess, that this very rock stands itself at the best but upon a frame of timber."

³¹ *Ibid.*, pp. 107 and 116-117.

beside the point. Since Christians, both Catholic and Protestant, accept scripture as divine and as a rule of faith, it can be appealed to as the standard by which to decide controversies. Controversies about scripture itself, however, cannot be so decided, since to appeal to scripture to settle a controversy about scripture would beg the question. Other means must be used to decide what the Scriptures are, which passages are clear or obscure in meaning, whether a given translation is good or poor, whether a given book is the work of an inspired author, and so on. The means for the solution to such problems is common to all men, namely, human reason. Further, and this is primary for our consideration, religious and secular problems are of the same kind, as also are the respective certainties one can have of their solutions. With respect to the accuracy of translation, for example, Chillingworth writes:

... the learned have the same means to satisfy themselves in it as in questions which happen about the translation of any other author; that is, skill in the language of the original, and comparing translations with it. In which way, if there be no certainty, I would know what certainty you [Knott] have that your Doway Old, and Rhemish New Testament, are true translations? ... Which way of proceeding, if it be subject to some possible error, yet is the best that either we or you have; and it is not required that we use any better than the best we have.³²

As to how the true meaning of scripture is to be gotten he continues:

If you ask me how I can be sure I know the true meaning of these places [of scripture]? I ask you again, can you be sure, that you understand what I, or any man else says? They that heard our Saviour and the Apostles preach, could they have sufficient assurance, that they understood at any time what they would have them do? If not, to what end did they hear them? If they could, why may we not be as well assured that we understand sufficiently what we conceive plain in their writings? ³³

The point made in both these statements is the same: the solution to theological difficulties is of the same kind as those to other practical problems; there is no special method to be used nor is there any kind of certainty here other than that had in ordinary affairs. This latter point is made clear in a comment concerning the language in which the Scriptures are written: "But we cannot be certain in what language the scriptures remain uncorrupted. Not so certain, I grant, as of that which we can demonstrate; but certain enough, morally certain, as certain as the nature of the thing will bear, so certain we may be and God requires no more." ³⁴

³² *Ibid.*, pp. 117-118.

³³ *Ibid.*, p. 166.

³⁴ *Ibid.*, pp. 127-128. In this same connection, in addition to Grotius, another source for some of Chillingworth's views may have been the French Reformation figure, Sebastien

In speaking of the Scriptures as the rule of faith Chillingworth limits himself to the written Scriptures. He does not deny the existence of an unwritten or oral tradition, but only that there is anyone to whom the Christian can have recourse in event of dispute about it. It is quite possible, he says, that God might have disposed matters so that there were two traditions, but in matter of fact he has not done so. Furthermore, since anything which is spoken can also be written, there is no warrant for saying there must be an oral tradition in addition to the written one.³⁵ Written scripture is the best rule presently available but is not the best one possible for it is not "evidently true" or "evidently credible," and stands in need of something that is so, namely universal tradition. Hence only the doctrine of the Universal Church of Christ through the ages is the perfect rule. Since this is not available, however, one is compelled to rely on such written scripture as has come down through the years from the hands of the apostles.

Castellio (1515-1563), who is noted for his opposition to Calvinism as a new authoritarian force, for his criticism of Calvin's execution of Servetus, and for his defense of toleration. One of his works which is of interest relative to Chillingworth's position is his *De Arte Dubitandi et Confidendi, Ignorandi et Sciendi*, written in the last years of his life. The work was recently published in the original Latin in 1937, and was published in French translation in 1953 as *De L'art de Doubter et de Croire, D'ignorer et de Savoir*, trans. Charles Baudouin, (Paris, 1953). The essay - as were some of Castellio's other works - was known and circulated in the seventeenth century, and Chillingworth may have known it directly or through his friends. Exactly how much Chillingworth knew of Castellio's writings is a problem needing further investigation. At any rate, it contains a liberal theological view similar to his own and may have been a source of some of his views on certainty.

In addition to particular theological doctrines which are similar, there are other points in Castellio's book worth noting for their relevance to our particular subject. A general theme of the book is that in matters of religion not everything is either wholly certain or uncertain; at different times and with respect to different matters, doubt, belief, ignorance, and knowledge are all justified. Indeed, says Castellio, there is an art to knowing when each is justified. More particularly, one of the major theses of the *De Arte Dubitandi* is that theological problems are to be solved in the same manner as the problems which arise in the affairs of ordinary life. Early in the book (pp. 48-49, French edition) he notes that it is necessary to believe Christianity on the same grounds as one believes any secular principle. The kinds of evidence one has and the criteria by which evidence is evaluated are the same in both domains. The agreement of witnesses with one another, the consistency of their accounts, and their trustworthiness, are all to be considered. Another point Castellio makes (p. 62), and which also appears in Chillingworth, concerns the transmission of the Scriptures from generation to generation. He notes that minor changes in wording may occur (and even admits the possibility of error), but that such changes do not affect the content any more than changes and even the loss of some passages in the text of Cicero's writings affect either what he says or one's respect for his writings. In the same connection he indicates (pp. 80-82) that in courts of law a distinction is made between knowledge and belief in the witness and judge, and points out that the same distinction holds also in religion, e.g., the apostle Thomas knew that Christ had arisen by seeing the wounds in his body, but other Christians can only believe on the evidence of the written testimony of the Bible. He says also (pp. 64-65), concerning what is testified by witnesses in a court of law or in religion, that one is required to accept the testimony of two or three witnesses so long as their general accounts agree, even though there is disagreement concerning details. To demand more agreement in such a case, in either sphere, would be unreasonable, not to say ridiculous.

³⁵ *Works*, p. 110.

The Bible, then, is the rule by which to decide controversies concerning beliefs necessary for salvation. It is a perfect and infallible rule, and is a sufficient though not always effectual means of deciding controversies. The rule is perfect in that there is contained in it all the objects of faith; nothing more than what it contains is required for salvation. The Bible is itself only the vehicle which conveys or carries the fundamentals; hence not it but what it contains is the object of faith.³⁶ In addition to the fundamentals of belief there is contained in the Scriptures much that is true and worthy of belief, but which is not necessary for salvation. As a rule the Scriptures would be perfect even if they contained only the fundamentals which must be believed for salvation. Since they are so written that the truth of these fundamentals is plain and evident to any person who reads attentively and seriously, they need no interpretation. The Scriptures are infallibly true, "for if it may be false in any one thing of this nature, in any thing which God requires men to believe, we can yield unto it but a wavering and fearful assent in any thing."³⁷ In saying that the Scriptures are infallible Chillingworth means not that this is known but only believed with a moral certainty on the basis of available evidence. Lastly, the rule is a sufficient means to end all controversy concerning what is necessary for salvation but is not always effectual. Nothing is lacking in scripture for such solutions, but only in the persons who make use of it.³⁸ The problem lies in the application of an infallible rule. The deliberating bodies of the Church have the authority to use the Bible to settle disputes, but in making their decisions do not always apply the rule so correctly as to produce a solution as true as the rule. If all the principles of scripture were applied correctly, the solution would be as certain as the rule itself, that is, infallibly true. He writes to Knott:

Again, methinks so subtle a man as you are, should easily apprehend a wide difference between authority in doing a thing, and infallibility in doing it ... that is, an authority of determining controversies of faith according to plain and evident scripture and universal tradition, and infallibility, while they proceed according to this rule ... I hope you will not deny, but that the judges have authority to determine criminal and civil controversies: and yet I hope, you will not say, that they are absolutely infallible in their determinations; infallible while they proceed according to law, and if they do so, but not infallibly certain they shall ever do so.³⁹

The decisions made by councils are not infallibly true. From this it does not follow, as Knott had argued that it should, that no certainty

³⁶ *Ibid.*, p. 171.

³⁷ *Ibid.*, p. 80.

³⁸ *Ibid.*

³⁹ *Ibid.*, p. 172.

could be had of the results of their deliberation. Some can be had, as much and of the same kind as in non-theological controversies. There is no certainty – absolute certainty – that the Church will follow her rule, but since the rule is believed to be infallibly true, there will be occasions when the truth is hit upon. One can be morally certain that her decisions are true. Chillingworth continues his objections:

Neither is your argument concluding, when you say – if in some things she [the Church] may be deceived she must be always uncertain of all such things ... Our judges are not infallible in their judgments, yet are they certain enough that they judge aright, and that they proceed according to the evidence that is given when they condemn a thief or murderer to the gallows. A traveller is not always certain of his way, but often mistaken: and doth it therefore follow that he can have no assurance that Charing-cross is his right way from the Temple to Whitehall? The ground of your error here, is not distinguishing between actual certainty and absolute infallibility. Geometricians are not infallible in their own science; yet they are very certain of those things which they see demonstrated: and carpenters are not infallible, yet certain of the straightness of those things which agree with the rule and square. So, though the church be not infallibly certain, that in all her definitions, whereof some are about disputable and ambiguous matters, she shall proceed according to her rule, and that, in this or that thing, she doth manifestly proceed according to it, she may be certain of the truth of some particular decrees, and yet not certain that she shall never decree but what is true.⁴⁰

The fact that in matters of religion one can at best have only moral certainty is no ground for dismay since this is the kind of certainty on which the great ventures of commerce, travel, and the like are based. This certainty of ordinary life is sufficient to produce action, and if it does this nothing more need be required of it. Indeed, Chillingworth goes so far as to say that if a man is willing to risk his property and wealth on moral certainty alone, he ought to feel no compunction about venturing the eternal destiny of his soul on the same kind of certainty:

For who sees not that many millions in the world forego many times their present ease and pleasure, undergo great and toilsome labours, encounter great difficulties, adventure upon great dangers, and all this not upon any certain expectation, but upon a probable hope of some future gain and commodity, and that not infinite and eternal, but finite and temporal? Who sees not that many men abstain from many things they exceedingly desire, not upon any certain assurance, but a probable fear, that danger may come after? What man ever was there so in love with a present penny, but that he would willingly spend it upon any little hope, that by doing so he might gain a hundred thousand pounds? And I would fain know, what gay probabilities you could devise to dissuade him from this resolution. And if you can devise none, what reason then or sense is there, but that a probable hope of infinite and eternal happiness, provided for all those that obey Christ Jesus, and much more a firm faith, though not so certain, in some sort, as sense or science, may be able to sway our will to obedience, and encounter with all those temptations which flesh and blood can suggest to avert us from it? Men may talk their pleasure of an absolute and most infallible certainty,

⁴⁰ *Ibid.*, pp. 203–204.

but did they generally believe that obedience to Christ were the only way to present and eternal felicity, but as firmly and undoubtedly as that there is such a city as Constantinople, nay, but as much as Caesar's Commentaries, or the History of Sallust; I believe the lives of most men, both papists and protestants, would be better than they are.⁴¹

Throughout his writings as we have viewed them, Chillingworth's primary concern as a theologian is to refute the claim of Knott that Protestantism, so long as it refuses to admit the spiritual jurisdiction of the infallible Roman Catholic Church, is damned. In the course of his refutation of Knott's *Charity Maintained* he presents, though not in an orderly way, an exposition of what is involved in human certainty. The general view he advances is that it is reasonable to demand certainty only in proportion to the evidence or the "credibility of one's motives" for accepting a belief as true. He distinguishes knowledge from belief and opinion, and for each of these indicates an appropriate kind or degree of certainty, ranging from absolutely infallible certainty to mere probability. Between the two extremes lies a range of certainty known as moral certainty, the certainty had by ordinary people about such commonplace things as the route from one town to another, that a certain person is one's father, or that a wall is straight. This kind of certainty is all that can reasonably be expected in matters of faith; it is the basis of his answer to Knott's contention that in religion one must have either infallible certainty or none at all. Chillingworth denies the possibility of the former with respect to the truths of Christianity and is unwilling to accept the nihilism of the latter. He takes a middle ground, holding that there is a measure of certainty possible, the certainty of the traveler, the merchant, the carpenter. Though such certainty is neither infallible nor provides protection against the threat of such skeptical arguments as the dream hypothesis or the hypothesis of universal deceit, it is the best that can be had under the circumstances and therefore must suffice. Thus for Chillingworth religious truth is propositional, the evidence for such truth is the same as for non-religious truth, and its certainty held to be in no way unique. The certainty of common sense thus becomes the basis for the solution to a philosophical problem about religion.

Against Chillingworth's view, however, objections can be brought. First, it is not clear what is meant by "evidence," "evidentness of the object," or "the credibility of one's motives to believe." Second, it is not clear whether certainty is wholly subjective – solely a matter of a feeling of confidence – or whether it is in some way objective – de-

⁴¹ *Ibid.*, pp. 430-431.

terminated by features of the object believed. Third, no criteria are given by which to distinguish what is doubtful from what is in the lowest degree morally certain, nor to distinguish the several degrees of moral certainty from one another. Since some of these problems are cleared up in the course of time in a later phase of the Rule of Faith controversy, let us turn to the writings of one of the principals involved in that later phase, John Tillotson.

SECTION II

JOHN TILLOTSON

John Tillotson, like Chillingworth, was a liberal Anglican theologian whose writings reflect interest in critical questions about religious knowledge. His views were developed in large measure, as was the case with Chillingworth some twenty-five years earlier, in controversies with Catholic apologists, and in his sermons. His views are important because they represent a development towards completeness and fuller expression of the position stated earlier by Chillingworth and because they were later employed by some of his friends who were founders and leading members of the Royal Society, of which he was himself a member.

The life of John Tillotson is the story of a clothier's son who by his own efforts rose to the Primacy of the Anglican Church.⁴² He was born in Sowerby, Yorkshire, in 1630. He entered Clare Hall College, Cambridge, and in 1654 received his M. A. While at Cambridge he became acquainted with the Platonists Cudworth, Whichcote, and More; though he did not take their Platonism seriously, he seems to have been affected by their views on moderation and toleration. During his stay at Cambridge he was also influenced by Chillingworth's *Religion of Protestants*. When he left Cambridge in 1656 he still adhered to the Calvinistic views of his parents, but was developing an interest in the principles of Anglicanism. His associations with the extremist clergymen present at Cromwell's death and at the induction ceremonies of the younger Cromwell so affected him that he turned completely away from Calvinism, and in 1660 was ordained in the Anglican Church.

⁴² For further details concerning Tillotson's life see the first chapter in Louis G. Locke's *Tillotson: A Study in Seventeenth Century Literature* (Copenhagen, 1954).

In this same period Tillotson became acquainted with one of the founders of the Royal Society, John Wilkins, whose stepdaughter, a niece of Oliver Cromwell, he married in 1663. Through the influence of Wilkins he soon afterwards was appointed to the Tuesday lectureship at St. Lawrence Jewry Church in London. His publishing career began in 1661 with the publication of a sermon; three years later he published another sermon, "The Wisdom of Being Religious,"⁴³ in which are found some of his views concerning certainty. In 1666 *The Rule of Faith*⁴⁴ was licensed for publication. After the death of Wilkins in 1672 he edited the latter's *Of the Principles and Duties of Natural Religion*.⁴⁵

For his efforts in aiding Wilkins in the publication of *Essay toward a Real Character and a Philosophical Language*⁴⁶ and because of his eminence as a preacher, Tillotson was elected to the Royal Society in 1671. Though he did not share the scientific interests of his stepfather-in-law, he was a member in good standing so far as payment of dues was concerned. Another member of the Society with whom he was particularly friendly was John Locke, with whom he collaborated in a scheme for the unification of Protestantism in England.

In 1668 he received his first appointment to Canterbury. Four years later he was promoted to the position of Dean of the Cathedral, and in 1691 was appointed Archbishop by King William whose intimate friend he had become some years before. He died in 1694.

The features which make up Tillotson's epistemological position are to be found scattered throughout his sermons, essays, and his *Rule of Faith*. He is quite conscious of holding certain views, recognizes his intellectual kinship with Chillingworth, Lucius Cary (1610-1643), and Edward Stillingfleet (1635-1699), and acknowledges his indebtedness to Aristotle. The arguments he presents occur in the context of his exposition of scripture, his attacks on atheism, and his reply to John Sergeant's *Sure Footing in Christianity*.⁴⁷ From these scattered sources several themes emerge. In examining the themes he develops we shall, as in the case of Chillingworth, first present his

⁴³ John Tillotson, "The Wisdom of Being Religious: A sermon preach'd at St. Paul's" (London, 1664). This sermon can be found in Tillotson's *The Works of the Most Reverend Dr. John Tillotson, Late Lord Archbishop of Canterbury: Containing Fifty Four Sermons and Discourses, Preached on Several Occasions. Together with the Rule of Faith*, 9th ed. (London, 1728), pp. 1-27. In this chapter reference will be made to this volume as *Works A*.

⁴⁴ John Tillotson, *The Rule of Faith: or, an Answer to the treatise of Mr. J. S. entitled Sure Footing, &c.* (London, 1666). This book is in *Works A*.

⁴⁵ John Wilkins, *Of the Principles and Duties of Natural Religion* (London, 1675).

⁴⁶ John Wilkins, *Essay toward a Real Character and a Philosophical Language* (London, 1668).

⁴⁷ John Sergeant, *Sure Footing in Christianity, or Rational Discourses On The Rule of Faith* (London, 1665).

views in an organized form and then show their relevance to the particular controversies in which he was involved.

Knowledge, according to Tillotson, is the comprehension of the nature of a thing.⁴⁸ Human, as compared with divine knowledge, is extremely limited in its extent both because of the objects involved and the mind itself. Because of its relation to the understanding – as when it is too small or too large, or too remote in space and time – or because of its own nature – as when it is too complex – the object may exceed the power of human comprehension. The mind itself is affected by temperament, education, prejudice, and personal interests. In addition there is the theoretical problem that all men are subject to error; the possibility is real and ever present that all men are deceived in what they accept as true.⁴⁹ As a consequence, man's knowledge is limited to the apprehension of appearances only: "we do not know things in their realities, but as they appear and are represented to us with all their masks and disguises."⁵⁰ The view that knowledge is limited to the appearances rather than to the reality of things becomes, as we shall see, one of the features of the theory of science developed in the Royal Society.

The fact that knowledge does not have for its object reality itself is no ground for despair or reason for accepting the claim that nothing can be known, that is, that there is no ground for assent and no certainty whatever. There are many things which are believed though they are not understood; men believe, for example, in the union of soul and body and the continuity of matter, though they do not comprehend how or why these occur.⁵¹ The way out of the theoretical difficulty, the possibility of universal deceit, is faith; God is a God of truth, hence he would not permit men always to be deceived: "that this is our make and temper, and the very frame of our understandings, to be then most of all deceived, when we think ourselves to be most certain; I say, no man could be assured of the contrary, but from hence, that *veracity* and *truth* is a *divine perfection* ... therefore we may be assured, that the frame of our understandings is not a cheat, but that our faculties are true."⁵²

⁴⁸ John Tillotson, *The Works of the Most Reverend Dr. John Tillotson. Late Lord Archbishop of Canterbury*, ed. Ralph Barker, 4th ed., Vols. II and III (London, 1728), II, 527. To distinguish this edition from the one volume ninth edition mentioned above it will be designated *Works B*.

⁴⁹ *Ibid.*, II, 583–584.

⁵⁰ *Ibid.*, II, 538.

⁵¹ *Ibid.*, II, 535.

⁵² *Ibid.*, II, 583–584. It is worth noting that in the sixth of his *Meditations* Descartes uses a similar argument as a basis for believing in the sensitive faculties. Both men also employ the

Having made the theologically based assumption that mankind is not universally deceived, one need not concede to the claim that nothing can be known. However, as there are still practical difficulties to be overcome, infallible certainty is not within grasp.

With respect to certainty itself Tillotson distinguishes the certainty of the object from the certainty of adherence or assent.⁵³ The first is the truth of a proposition apart from its relation to the mind. In a discussion of religious problems he points out that there are two approaches to religious principles: either one measures the truth of such principles or doctrines by the strength of his belief in them, or one rations his belief by their truth. The first way is to be eschewed. Of every pair of alternatives one must have been true before anyone thought about it: either there is a God or there is not, either the soul is immortal or it is not, and so on. Things are what they are and are in no way affected by being believed or disbelieved; hence of each set of alternatives "one of these is certain and necessary, and not now to be altered."⁵⁴ This being the case, belief does not affect the truth of a statement, but ought to be proportioned to the evidence for its truth.

Of the certainty of adherence Tillotson has more to say since this is for him the more important aspect of certainty. In the first place, as Chillingworth had maintained earlier, it is beyond the reach of man to be infallibly certain of anything, where by infallibility is meant "*an absolute security of the understanding from all possibility of mistake in what it believes.*"⁵⁵ It is always possible, even in cases where the evidence seems utterly beyond question, that errors occur. In geometry, for example, where the passions are least likely to interfere, the wording of propositions is never so clear as to exclude all doubt as to their meaning. Even in the case of very clear sense perception it is always possible that

notion that God the creator left his mark on his work, and so man cannot always be subject to error.

⁵³ *Works A*, p. 562.

⁵⁴ *Ibid.*, p. 25. In the same paragraph he states further: "Think thus with your selves, that with your selves, that you have not the making of things true or false, but that the truth and existence of things is already fix'd and settled, and that the principles of Religion are already either determinately true or false before you think of them ... the truth of things will not comply with our conceits, and bend it self to our interests. Therefore do not think what you would have to be, but consider impartially what is, and (if it be) will be whether you will or no." For a somewhat similar statement which echoes Chillingworth's doctrine that something may be true though we have no evidence it is, see pp. 20-21, where he writes: "... our belief or disbelief of a thing does not alter the nature of the thing. We cannot fancy things into being, or make them vanish into nothing by the stubborn confidence of our imaginations. Things are as sullen as we are, and will be what they are whatever we think of them. And if there be a God, a man cannot by an obstinate disbelief of him make him cease to be, any more than a man can put out the Sun by winking."

⁵⁵ *Ibid.*, pp. vi and 562; see also *Works B*, II, 429.

the object may be other than one perceives it to be. If infallibility could be achieved, "there are but two ways for the understanding to be thus secured; either by the perception of its own nature, or by supernatural assistance. But no human understanding being absolutely secur'd from possibility of mistake by the perfection of its own nature ... it follows, that no man can be infallible in any thing, but by supernatural assistance." ⁵⁶

Lower than infallible but higher than moral certainty is a kind of certainty – unnamed by Tillotson – based on either immediate sense perception or demonstration. The evidence of the senses, particularly sight and hearing, gives the highest assurance of anything one has in this world.⁵⁷ Taking the Aristotelian tradition in philosophy as emphasizing knowledge based upon the senses and the Platonic tradition as emphasizing non-sensitive mathematical knowledge, Tillotson follows the Aristotelian point of view in making sense perception the fundamental source of knowledge, and consequently of certainty. On this point he is more precise than was Chillingworth. Another level of certainty arises from demonstration, though it is not wholly clear whether this is equal to or less than that arising from sense perception. Since demonstration, as will be noted below, is a kind of evidence the denial of which necessarily involves a contradiction, the certainty it warrants must be stronger than moral. Of these two degrees of certainty, sensitive and demonstrative, little more is said.

Since without divine assistance infallible certainty is out of the question and since its destructive effects on human life make absolute skepticism objectionable, Tillotson deals most extensively with a level of certainty which he calls "sufficient assurance" or "moral certainty." This is the certainty apropos of belief as distinct from knowledge, where belief or faith (they are identical for Tillotson) is defined, following, he says, common usage, as "a persuasion of the mind concerning anything."⁵⁸ From his reading of *Rushworth's Dialogues*⁵⁹ and his contro-

⁵⁶ *Works A*, p. vi.

⁵⁷ *Works B*, II, 110; see also III, 411.

⁵⁸ *Ibid.*, III, 409.

⁵⁹ One passage from *Rushworth's Dialogues* to which Tillotson specifically refers is from the preface by Thomas White in which are presented some of the motives giving rise to the idea of moral certainty and some of the different meanings of the term. "Of these Divines, the ancients (observing the condition of *obscurity* in our faith much inculcated both by Scripture and Fathers, and finding *obscurity* oppos'd to evidence, and faith, by it, to *Science*, and not distinguishing in *Science* the two notions, *Evidence* and *Certainty*) easily fell into this mistake, of thinking *obscurity* in faith the same as in opinion, yet being persuaded the *certainty of faith* was greater than of *Science*; they were much perplexed how to reconcile *obscurity* with *certainty*; and so found out a distinction of *moral* and *physical* certainty, of which they

versy with John Sergeant he is quite aware that the term can have a variety of meanings and therefore specifies his own: "*In brief, then, tho' moral certainty be sometimes taken for a high degree of probability which can only produce a doubtful assent, yet it is also frequently us'd for a firm and undoubted assent to a thing upon such grounds as are fit fully to satisfy a prudent man; and in this sense I have always used this Term.*"⁶⁰ At another place he says, comparing infallible with moral certainty, that the latter "doth not exclude all possibility of Mistake, but only all just and reasonable cause why a prudent and considerate Man should doubt."⁶¹ Moral certainty is the assurance one has of any argument to the conclusion of which assent is freely given. Moral certainty is the certainty of daily life about matters of fact; the enterprises of business and travel, for example, are based upon it. The merchant is not infallibly certain that on a given investment a satisfactory return will be made, but were he not sure of a profit he would make no investments. A traveler has only a moral certainty, not an infallible one, that the ship on which he embarks will not sink midway across the ocean and that the pilot will guide the ship safely to port. Since such certainty suffices for the secular affairs of life, argues Tillotson, it should also be sufficient for the really important venture of life, the soul's journey to God:

And for any man to urge that tho' men in temporal affairs proceed upon moral assurance, yet there is greater assurance required to make men seek Heaven and avoid Hell, seems to me

thought *moral*, though a lesser, yet a certainty. Then dividing the assent of Faith into two Principles; The one, *what God Said was true*; the other, *God had said the proposition to be believ'd*. To its proper proofs, which they termed the motives of credibility, they attributed this *moral certainty*. But being distrustful, that the help of the other proposition could not elevate the Conclusion to a degree of certainty, above Science and any other natural vertue; They fled some to the habit of Faith, some to previous Illuminations, or other means, as every one found most suitable to his humour...

"This term *morall certainty* every one explicated not alike; but some understood by it such a certainty as makes the cause alwaies work the same effect, though it take not away the *absolute possibility* of working otherwise. Others call'd that a *morall certainty*, which proceeds from and depends on moral principles, as commands, perswasions intreaties &c. A third explication of this word is, such a certainty as seldom fails, or such as human action is generally grounded on.

"Of these three, the first ought absolutely be reckon'd in the degree of *true certainty*, and the Authors consider'd, as mistaken in undervaluing it. Am I not sure I shall never repeat in the same order all the words I have spoken this last year? yet these men will say, I am onely *morally certain*. The second no lesse deserves the title of *true certainty*, if rightly understood. What more unquestionable, then that in *Europe* some wil remain Christians tomorrow. yet this distinction diminishes it into a *morall certainty*. The third belongs to others, more bold, who have dared to affirm expressly, that the motives of credibility are absolutely insufficient to beget a certain and undoubted assurance, being themselves contain'd within the bounds of pure probability: and that when the distinction urged against the mysteries of Faith are compar'd with the arguments inducing to believe them, their credibility wains according to the strength of the objections ..."

⁶⁰ *Works A*, p. vi.

⁶¹ *Works B*, III, 429.

to be highly unreasonable. For such an assurance of things as will make men circumspect and careful to avoid a lesser danger, ought in all reason to awaken men much more to the avoiding of a greater; such an assurance as will sharpen mens desires and quicken their endeavours for the obtaining of a lesser good, ought in all reason to animate men more powerfully and to inspire them with a greater vigor and industry in the pursuit of that which is infinitely greater.⁶²

There can be no degrees of infallible certainty since there are no degrees of absolute impossibilities and perfect contradictions.⁶³ On the other hand, there are degrees of moral certainty. On some occasions one is more certain than on others, though in any instance of moral certainty there is no just cause for doubting. The factors determining the degrees of certainty are two, the capacity of the person who has the belief and the evidence for the belief. Since the intellectual capacities of different persons may vary widely, the intensity of their persuasions may correspondingly vary. On the other hand, assuming a constancy in the ability of a person to evaluate the evidence, his assurance will be greater or less as the arguments or evidence are of greater or lesser strength.⁶⁴

When the question is raised as to the justification or reason for satisfaction with less than infallible certainty, particularly in matters of faith, Tillotson appeals to the principle of Aristotle to which Chillingworth had made oblique reference, that there are different kinds of subject matter each with its own kind of proof, and that it is the mark of a reasonable man to demand for a given subject matter only that kind of proof and that degree of certainty which is proper to it. One needs only such evidence as the case admits and as is acceptable to a reasonable man. The section of Aristotle's *Ethics* to which Tillotson refers is the statement:

Our discussion will be adequate if it has as much clearness as the subject-matter admits of, for precision is not to be sought for alike in all discussions, any more than in all the products of the crafts ... In the same spirit, therefore, should each type of statement be *received*; for it is the mark of an educated man to look for precision in each class of things just so far as the nature of the subject admits; it is evidently equally foolish to accept probable reasoning from a mathematician and to demand from a rhetorician scientific proofs.⁶⁵

⁶² *Works A*, pp. 23-24.

⁶³ *Ibid.*, p. 562.

⁶⁴ *Works B*, III, 411.

⁶⁵ Aristotle, *Nicomachean Ethics*, I, 3. Tillotson's version of this principle is formulated as follows: "It is sufficient that the Evidence be such as the Nature of the thing to be proved will admit of, and such as prudent Men make no scruple to admit for sufficient Evidence for things of the like Nature, and such as, supposing the thing to be, we cannot ordinarily expect better, or greater Evidence for it" (*Works B*, II, 110).

In addition to outlining the several kinds of certainty of assent and the circumstances under which each justifiably occurs, Tillotson also examines the kind of evidence required for each. Following Aristotle's principle concerning the proportionality between subject matter and kind of proof he makes, at one point, the following classification: "Mathematical things, being of an abstracted nature, are capable of the clearest and strictest *Demonstration*: But Conclusions in *Natural Philosophy* are capable of proof by an *Induction* of experiments; things of a *moral* nature by *moral* arguments; and *matters of fact* by credible testimony."⁶⁶ In the development of this classification the first kind of proof or evidence, demonstration, is distinguished from the others by the fact that in it alone the denial of the conclusion necessarily involves a contradiction.⁶⁷ This is significant since it makes the difference between demonstration and other proofs, and the certainty based upon them, depend upon a principle of logic. That proofs can be so distinguished from one another does not, however, prejudice the other kinds; because there are no demonstrations of matters of fact it does not follow that such proofs as exist are worthless. So long as anything is proved by the best argument in its kind a sufficient assurance can be had of its truth.⁶⁸

Depending upon the context in which he is writing, demonstration, sense, or both are classed as the highest kind of evidence.⁶⁹ The role of demonstration as a kind of proof or evidence is not made clear in Tillotson's writings. Mathematics, because of its "abstracted nature" can be so proved but not matter of fact. Demonstrations are spoken of as the strictest kind of proof, but what degree of certainty they warrant is not clear; not infallible certainty since that is beyond man's reach, nor moral certainty since denial of whatever is only morally certain does not necessarily involve a contradiction. Presumably it yields what Chillingworth called mathematical certainty, though Tillotson does not use the term.

Tillotson's primary concern is with evidence for matter of fact: the senses, experience, and the testimony of witnesses. The best evidence

⁶⁶ *Works A*, p. 16. This statement is almost an exact replica of the statement from Hugo Grotius' *Truth of the Christian Religion* quoted by Chillingworth on pages 477-478 of the *Religion of Protestants*. See fn. 18 above.

⁶⁷ *Works A*, p. iii.

⁶⁸ *Ibid.*, p. 16. He writes: "No man can demonstrate to me (unless we will call every argument that is fit to convince a wise man is a demonstration) that there is such an *Island* in *America* as *Jamaica*. Yet upon the testimony of credible persons who have seen it, and Authors who have written of it, I am as free from all doubt concerning it, as I am from doubting the clearest *Mathematical* demonstration."

⁶⁹ *Works B*, III, 110.

for any matter of fact is immediate sense perception. For anything which can be immediately seen or heard the evidence is so strong that even the strongest demonstration of the contrary is not sufficient to shake it.⁷⁰ God being the guarantor of the veracity of the senses there is no reason whatever to believe that they do not present things as they are; if the senses could not be trusted all certainty of matter of fact would inevitably crumble. As an indication of its relative position, he sometimes speaks of it as "ocular demonstration."⁷¹ Experience is the next highest degree of evidence, but this is not clearly described. Sometimes it is the same as sense perception, in which case whatever can be said of that can also be said of this. But it need not be. The only example given is that by experience one can be certain he has a freedom to act or not to act in a given situation.⁷² Perhaps such evidence is of the same order as what Locke was later to call internal sensation.

The lowest in the scale of kinds of evidence, but the one most often appealed to in both secular and sacred affairs, is the testimony of witnesses. Before his testimony can qualify as evidence a witness must satisfactorily pass two tests: he must have both intelligence and integrity. He must have such mental capacities as enable him to have "competent knowledge" of the facts or events to which he gives witness. Similarly, he must be free from malicious intent or design to mislead or deceive in the giving of his testimony. If he has these qualities his testimony can be accepted as evidence upon which to base moral certainty.⁷³

Before examining the use Tillotson makes of this theory of certainty in his arguments with Catholic apologists and atheists, it will be worthwhile to summarize it. Human knowledge is limited because of the complexity of things to be known and the frailty of human under-

⁷⁰ *Ibid.*, II, 67; see also *Works A*, p. 196.

⁷¹ *Works B*, III, 411. Tillotson bases his argument against the doctrine of Transubstantiation on the principle that the senses are to be trusted; he writes: "But if this Doctrine be true, then all mens senses are deceived in a plain sensible matter, wherein 'tis as hard for them to be deceived as in anything in the world: For two things can hardly be imagin'd more different, than a *little bit* of wafer and the *whole body* of a man. So that the Apostles persuading men to believe this Doctrine persuaded them not to trust their senses, and yet the Argument which they used to persuade them to this was built upon the direct contrary principle, that *mens senses are to be trusted*. For if they be not, then notwithstanding all the evidence the Apostles offer'd for the resurrection of our Saviour, he might not be risen ... If the testimony of *sense* be to be relied upon, then *Transubstantiation* is false; If it be not, then no man is sure that Christianity is true. For the utmost Assurance that the Apostles had of the truth of Christianity was the testimony of their own senses concerning our Saviour's Miracles" (*Works A*, p. 96).

⁷² *Works B*, III, 411.

⁷³ *Ibid.*

standing. Although the arguments against any certainty whatever are almost overwhelming one can by an act of faith be assured that some certainty is possible. The degrees of certainty range from sensitive and demonstrative down to moral certainty, each depending upon its peculiar type of evidence. Belief as distinct from knowledge is a persuasion of the understanding concerning the truth, excellence, futurity, and so on of anything, and generally has no more than a moral certainty. This persuasion is greater or less as the evidence varies correspondingly. For any evidence to be acceptable it must be such as would convince a reasonable person and such as the nature of the case admits. The evidence for religious belief is of the same kind as that relevant to the affairs of the merchant and traveler.

Of Tillotson's many interests we shall confine ourselves to only two, his attacks on Catholic apologists and on atheism. We shall consider first his reply to the arguments of John Sergeant's *Sure Footing in Christianity* as a late development in the Rule of Faith controversy, an interest he shared with Chillingworth, and then his attack on atheism, an interest he shared with Henry More.⁷⁴

The *Rule of Faith* of 1666 is a reply to John Sergeant's *Sure Footing in Christianity*, published a year earlier. The issue between them is by what rule or criterion one can judge religious beliefs to be true. The rule must be infallible if no false doctrines are to become part of Christian belief. If the criterion of infallibility is the infallible Pope, as

⁷⁴ One of Tillotson's contemporaries who shared with him an interest in refuting atheism was the Platonist Henry More. Unlike Tillotson and most of the others we shall study, More was a professional philosopher with a systematic metaphysical theory. We are not particularly interested here in either his Platonic metaphysics or theory of knowledge but only in his views as exemplifying the ubiquity in English thought of the movement with which we are concerned. More's judgment of his own times in his *An Antidote Against Atheism*, part of which is reprinted in *Philosophical Writings of Henry More*, ed. Flora I. Mackinnon (New York, 1925), is that it is a period of transition from an age of superstition to an age of reason, but withal a period in which the transition is being made so rapidly that in throwing off superstition men have become so exuberant that there is a tendency to throw off all religion. This complete rejection of religion is unreasonable and gives rise to atheism (p. 2). Like Tillotson he distinguished two varieties of atheism, Epicurean and Aristotelian. To undermine the arguments of atheists by proving that there is a God thus becomes one of More's purposes as a writer on theological problems. More admits at the outset that his arguments do not demonstrate conclusively that there is a God, that though he speaks of them as demonstrations his arguments are only proofs (pp. 3-7). Demonstration in the strict sense can occur only where the evidence is such that one is forced to confess that it is impossible for the thing demonstrated to be otherwise; in the wide sense of demonstration or proof assent is given freely in accordance with the persuasiveness of the evidence. In addition More argues that such proofs as there are for God's existence are such as will win assent from an unprejudiced mind. The appeal is made, as in Chillingworth and Tillotson, to the reasonable man, to common sense. Such arguments as there are for God's existence will not satisfy anyone seeking an irrefutable demonstration nor anyone who is not willing to accept any kind of proof at all, but for an unprejudiced person of normal intelligence who makes use of his faculties, such proofs are convincing.

Sergeant maintains, then questions arise as to how one knows infallibly that a given person is Pope and infallible, and how this knowledge is transmitted from generation to generation. If the written Scriptures are the rule of faith, as Tillotson maintains, questions arise as to how one knows which books are canonical, what doctrines are contained in them, and even what the meanings of the sentences and words are. The stakes in the controversy are high, eternal life, for involved is the question whether Roman Catholicism or Protestantism is the one true religion. We shall present Tillotson's position in a two-fold manner: first a review of his criticisms of Sergeant's arguments, and then a presentation of his arguments in defense of his own position.

Sergeant's claims for his rule and the premises on which they rest are, says Tillotson, indefensible. He claims that it is impossible for the oral tradition to fail. Second, he claims that his rule is self-evident and then attempts to prove its self-evidence. Finally, he argues that the oral tradition is the only means whereby the doctrines of the Church can be transmitted from generation to generation. His arguments for these claims, says Tillotson, are based on contradictory principles. On the one hand he denies to Protestants the ability to translate the Scriptures correctly from one language to another or even to see without mistake what is written on the page of a book, both of which require dependable senses. On the other hand he claims that the doctrines of the Church can be transmitted by word of mouth from father to son and from generation to generation without corruption. But since this too involves the use of the senses, he is keeping for himself what he denies to others. His position also gives rise to skepticism in that he demands for a rule of faith an unreasonable kind of certainty; he derides Protestants because their Scriptures do not yield demonstrations that there are no errors in scripture.⁷⁵ By demanding demonstrations where they are neither possible nor necessary he is going far beyond the most renowned of skeptics, for "*Pyrrho* himself never advanced any *Principle of Scepticism* beyond this, *viz.* That Men ought to question the Credit of all Books, concerning which they cannot demonstrate as to every Sentence in them, that the Particle (not) was not inserted (if it be affirmative) or left out (if it be negative). If so much be required to free a Man from reasonable Doubting concerning a Book, how happy are they that have attained to Infallibility?"⁷⁶

The basis, according to Tillotson, of Sergeant's position is his belief

⁷⁵ *Works A*, pp. 550-551.

⁷⁶ *Ibid.*, p. 564.

that no evidence but demonstration can produce full assurance of anything, and that the bare possibility of doubt is a sufficient ground for withholding assent. The difficulty upon which this system rests is the failure to see that there are different kinds of situation, each requiring a different kind of proof and yielding a different kind of certainty. He claims for the oral tradition the certainty of demonstration, a certainty of which it is not capable since questions concerning the transmission of doctrine from father to son are questions of fact. Further, even if demonstrations were possible in such matters, there is no guarantee that one could be absolutely certain of their truth. Tillotson asks of his opponent:

Is Mr. S. sufficiently assured that there is such a Part of the World as *America*? And can he demonstrate this to any Man without carrying him thither? Can he show by any necessary Argument, that it is naturally impossible that all the Relations concerning that Place should be false? When his Demonstrations have done their utmost, cannot 'a searching and sincere Wit at least maintain his Ground of Suspense with a Might it not be otherwise'? And, with an Is it not possible that all Men may be Lyars, or that a Company of Travellers may have made use of their Privilege to abuse the World by false Reports, and to put a Trick upon Mankind? ... Who can tell but all this may be so? And yet I suppose notwithstanding the Possibility of this, no Man in his Wits is now possessed with so incredible a Folly as to doubt whether there be such a Place.⁷⁷

The position Tillotson tries to defend as his own is that the Bible is a sufficient rule of faith. The reasons offered for accepting it as the rule are that it has been accepted by Christians of all ages, Christians have been persecuted for adherence to it, and it has been used by the early Church Fathers in their sermons; none of these would have occurred if it were not the rule of faith.⁷⁸ There is as much or more assurance that the Scriptures are not corrupted as there is for the integrity of any secular text. It is incredible, Tillotson says, that God would permit the corruption of the book of which he is the author. Also, present editions agree with older ones, and scripture passages cited in old books agree with present editions.⁷⁹ The possibility that errors may have crept in is not alone enough to sway confidence in the truth of the rule since possibilities do not argue strong probabilities. He argues:

The Case is the very same as to the Certainty of an ancient Book, and of the Sense of plain Expressions: We have no Demonstrations for these Things, and we expect none because we know the Things are not capable of it. We are not infallibly certain that any Book is so

⁷⁷ *Ibid.*, p. 559.

⁷⁸ *Ibid.*, p. 536. It is interesting to note that these reasons are also cited by Grotius in the early chapters of the *Truth of the Christian Religion*.

⁷⁹ *Works A*, pp. 535-536.

ancient as it pretends to be, or that it was written by him whose Name it bears, or that this is the Sense of such and such Passages in it; it is possible all this may be otherwise, *that is*, it implies no Contradiction: But we are very well assured that it is not; nor hath any prudent Man any just Cause to make the least Doubt of it. For a bare Possibility that a Thing may be, or not be, is no just Cause of doubting whether a Thing be or not. It is possible all the People of *France* may die this Night; but I hope the Possibility of this doth not incline any Man in the least to think it will be so: It is possible the Sun may not rise to Morrow Morning; and yet, for all this, I suppose no Man hath the least Doubt but that it will.⁸⁰

In the preface to his collected works Tillotson answers objections raised by Sergeant against the *Rule of Faith*. To the criticism that acceptance of less than an infallible certainty argues for a possibility of falsehood in the faith Tillotson replies that he admits the possibility but that this does not justify any doubting: "All that I say is *this*, *That we are not infallible either in judging of the Antiquity of a Book, or of the Sense of it; by which I mean ... that we cannot demonstrate these things so, as to shew that the contrary necessarily involves a contradiction; but yet that we may have a firm assurance concerning these matters, so as not to make the least doubt of them.*"⁸¹ In defending his acceptance of "sufficient assurance" or "moral certainty" as adequate in religious matters Tillotson uses the same justifications as did Chillingworth. There is the theoretical principle borrowed directly from Aristotle that different subject matters require different kinds of proof and the practical justification that only as much certainty is needed as produces results, that is, "*such a belief as will save a man hath the true nature of Faith, though it be not infallible.*"⁸²

Some of Tillotson's views on certainty arise in the course of his sermons on atheism as well as in his attacks on Catholic apologists. His general strategy is to show the folly of atheism by establishing the wisdom of being religious; of his general plan we shall concern ourselves primarily with his direct attack on atheism. Atheism, in the last analysis, has a basis in morality; some men are wicked and to justify their wickedness claim that there is no God.⁸³ There are two kinds of atheism to be distinguished, Aristotelian or speculative atheism, and Epicurean or practical atheism. The one denies on theoretical grounds the existence of God, immortality, and future rewards; the other admits their existence but claims they have no relevance for everyday life.⁸⁴ The latter kind is dismissed summarily: such persons are out of

⁸⁰ *Ibid.*, p. 559.

⁸¹ *Ibid.*, p. iii.

⁸² *Ibid.*, p. v.

⁸³ *Ibid.*, p. 29.

⁸⁴ *Ibid.*, p. 5.

their wits and should be confined in Bedlam. It is with speculative atheism that Tillotson is primarily concerned.

The speculative atheists are not named, but their position is rejected on at least five counts.⁸⁵ In the first place, atheists can provide no acceptable account of the existence of the world, whereas theists can provide arguments for their belief that the world was created. Tillotson claims that though none of these amounts to a demonstration each nonetheless puts the weight of the evidence on one side, and "if this have been made evident, I desire to know whether this be not upon the matter as satisfactory to a wise man as a *Demonstration*? For in this case there can be no doubt on which side the clear advantage of evidence lies, and consequently which way a prudent man ought to determine assent."⁸⁶ In the second place, speculative atheism gives no account of the universal consent of mankind that there is a God. The human mind, says Tillotson, is such that there is stamped on it an idea of God; God could not but leave the mark of his own workmanship on his creatures.

The third argument against atheism is by far the most important one. The arguments of atheists require more evidence than the nature of the case admits. They fail to see that the question of the existence or non-existence of a God is not

Mathematically demonstrable, nor can it be expected it should, because only Mathematical matters admit of this kind of evidence. Nor can it be proved *immediately* by *sense*, because *God* not [sic] being supposed to be a pure spirit, cannot be the object of any corporeal sense. But yet we have as great assurance that there is a God as the nature of the thing to be proved admits of; and as we would in reason expect to have, supposing that he were.⁸⁷

The kinds of proof Tillotson thinks the nature of the case admits are a proof based upon the notions impressed on the mind of man, arguments from visible and external effects which reason shows must be attributed to a first cause, and the argument from design.

The next arguments are corollaries to the preceding ones. The atheist to defend his position must be certain of what no one can demonstrate, namely, that it is not possible that there be a God; he must demonstrate a negative statement, which, claims Tillotson, is impossible. In the last place, argues Tillotson, atheism is unsafe. Using a wager argument similar to that of Pascal he argues that if Christianity is false the believer will lose only some of the baser pleasures of life,

⁸⁵ *Ibid.*, pp. 5-19.

⁸⁶ *Ibid.*, p. 11.

⁸⁷ *Ibid.*, p. 18.

whereas if it is true that there is a God and future rewards the atheist will lose his soul for eternity. With respect to life after death:

... if there be no God the case of the Religious man and the Atheist will be alike, because they will both be extinguished by death and insensible of any further happiness or misery.

But then if the contrary opinion should prove true, that there is a God ... where shall the wicked and ungodly appear? And what think we shall be the portion of those who have affronted God, and derided his word, and made a mock of everything that is sacred and religious? What can they expect but to be rejected by him whom they have renounced, and to feel the terrible effects of that Power and Justice which they have despised? So that tho' the arguments on both sides were equal, yet the danger is not so. On the one side there is none at all, but 'tis infinite on the other.⁸⁸

The arguments of the speculative atheist are, then, unsound not only with respect to the existence of God but also concerning the possibility of what may occur after death. There are arguments to prove the existence of God, but even if such arguments were not conclusive, argues Tillotson, it would be prudent to believe because of the possible consequences of unbelief. Atheism, then, is to be rejected because of the weakness of its arguments and its possible consequences.

The relation between the views of Chillingworth and Tillotson and their mutual relation to Francis Bacon can now be stated. There are both affinities and differences between the views of Chillingworth and Tillotson. The structure of their positions is generally alike though there are differences in terminology and on minor points. Both are, in one phase of their thinking, concerned with the problem of certainty. For both there is on the one hand, ideally at least, an absolute or infallible certainty not attainable by man and on the other, the abyss of skepticism which is to be shunned. Both take the arguments of the skeptic seriously, admitting that there is no rational way to void or counter them. But a solution can be found, and that is to disregard their arguments. The certainty of the common man in his ordinary affairs is taken as the standard by which to judge of truth; the non-philosopher is not affected by the skeptic's arguments any more than Diogenes was by Zeno's arguments against motion, hence the certainty he has is made the standard for the solution of philosophical problems about religious belief. The embellishment of this solution involves the doctrine of Aristotle that for each kind of situation there corresponds a kind of proof and that one's degree of certainty ought to be determined by the objective relation of evidence to the situation. Certainty has both objective and subjective features. On the one hand both men claim that the object of belief is itself certain, and that there is the objective

⁸⁸ *Ibid.*, p. 31.

relation between subject and evidence just mentioned; on the other the certainty of assent is the persuasion or feeling of assurance one has of anything, the strength of which should be determined by the evidence.

These principles, some of which are only implicit in Chillingworth, are all explicit in Tillotson. But there are some features of Tillotson's position which should be pointed out both to indicate his advance beyond Chillingworth and to indicate some consequences of which he himself may not have been aware. Tillotson's views have the advantage of precision over Chillingworth's. He gives definitions of such crucial terms as "knowledge," "belief," "absolute certainty," and "moral certainty." He presents the standards any demonstration must meet before it can be accepted, and specifies some of the conditions testimony must fulfill before it can be accepted as evidence. Tillotson recognizes, finally, that knowledge of the real structure of nature is not possible because of the deceptiveness of sense perception and the complexity of nature; knowledge is limited to appearances only. There are difficulties too, however. He argues in the first place that there is both an objective certainty of the object of belief and a subjective certainty that it is true. However, he offers no guarantee that the two are always connected. A proposition may be objectively true, but the certainty one has of it may not correspond exactly to its truth value. This being so, the subjective certainty may not be determined by the evidence for it; once this occurs, certainty may become a wholly subjective psychological matter unrelated to evidence. In the second place, he argues that although there are no demonstrations for matters of fact there can nevertheless be demonstrations for mathematics, and that for such proofs there is a degree of assurance higher than moral certainty. But the question can be raised whether demonstration is possible at all. Tillotson admits that one can at best be only morally certain that what he sees on the printed page is actually there or that a statement means what one thinks it does. This being so, it is difficult to see how demonstrative conclusions are possible, since at best one's premises are only morally certain. Any certainty higher than moral certainty is thus put in jeopardy. The third problem which can be raised concerns the criteria any proof must meet to be acceptable. There are two such standards: the proof must be appropriate to the subject and the best of its kind, and must be acceptable to a reasonable man. The question can be raised whether the last requirement may not eventually lapse into "what is agreeable to me" since everyone

regards himself as reasonable. Since one of the standards for acceptability of a proof is the feeling of satisfaction of the person to whom the proof is proposed, the whole matter of proof and certainty may become entirely subjective. Tillotson, it must be remembered, was claiming that the firmness of one's assent is determined by strength of evidence, but the way is being prepared for the collapse of this relation.

It should be noted, in conclusion, that the theories of both Chillingworth and Tillotson differ extensively from that of Francis Bacon. Whereas he had hoped for an absolute certainty, they were willing to settle for moral certainty – the certainty of the reasonable man – a view which was later adopted by the Royal Society group. Whereas he had maintained that certainty can be achieved only as a result of the rigorous application of a mechanical method, they required no method except ordinary intelligence in evaluating such evidence as is available. Finally, the aim of Bacon's man of science was to discover the underlying, real structure of nature as a basis for the welfare of man. In the case of Tillotson, at least, the view was put forward that such knowledge of nature is not possible, but that knowledge is limited to appearances only. It is this view, together with Bacon's utilitarianism, which later became the accepted point of view of the Royal Society group. We now turn to the formulation of the theory of certainty in the context of science by two clergymen active in the Royal Society, John Wilkins and Joseph Glanvill.

THE THEORY OF CERTAINTY SECULARIZED

Having dealt in the last chapter with the problem of certainty as it arose in religious controversies, we now turn to the formulation of the problem in the context of secular affairs. The views of John Wilkins and Joseph Glanvill, two early members of the Royal Society, will be examined; though not remembered for their scientific accomplishments they had an interest in certainty relative to scientific theory. An attempt will be made to show that the views concerning the certainty of knowledge developed by Chillingworth and Tillotson are so reformulated as to be applicable to the results of scientific inquiry as well as to religious belief. In their writings there is an explicit recognition of the limitations of knowledge, but also an insistence that so long as one tries not to overstep these bounds, a creditable theory of science can be developed. Involved in this is the claim that knowledge is limited to the description of observed phenomena, and that science is not an account of the inner structure of nature, as proposed by Bacon. In particular, it will be pointed out in some detail that two levels of uncertainty are recognized and dealt with. There is first the extreme view that one thing is no more probable than another, which justifies suspension of judgment altogether. This radical doubt, since it would make science impossible, is rejected. Secondly, there is a prudent reserve of judgment, a cautious assenting to evidence, an avoidance of dogmatism. According to this view, which was accepted, it is asserted that science as the demonstrative knowledge of causes is not possible, but declared that an account can be given of observed phenomena, though such an account is open to correction and thus involves a restraint in assent.

In presenting Wilkins' contributions a quite extended account of his life and writings will be given, since he was the person perhaps most responsible for the founding of the Royal Society and the development

in scientific thought of the theory of certainty stated with respect to religion in the last chapter. Wilkins did not explicitly formulate the theory we are considering in the context of scientific theory, but because of his association as a teacher with so many of the scientific members of the Society and because of his role as a founder it is worth considering his views in some detail. His formulation occurs in the context of an attempt to establish natural religion on reason. But the theory is so stated as to apply to scientific knowledge as well. In Glanvill's writings the theory is secularized, severed from its religious context and explicitly stated with respect to scientific theory, though not applied to bona-fide scientific discoveries. One difference between Wilkins' and Glanvill's formulations that is worth noting at the outset is that Wilkins emphasized the positive side of knowledge, examining in detail what can be known, whereas Glanvill tended to emphasize the negative, pointing out what cannot be known.

SECTION I

JOHN WILKINS

The career of John Wilkins was marked by success in all ventures, both ecclesiastical and scientific.¹ He was born in 1614, son of an Oxford goldsmith. He took his B. A. and M. A. at Magdalen College, Oxford, in 1631 and 1634, respectively, and, after tutoring for several years, took orders. In 1637 he became vicar in the town where he was born, Fawlsley. To this point his life was quite uneventful, but (says one of his biographers) "on realizing that he could promote his interests better by attaching himself to persons of influence he resigned his benefices." After serving as private chaplain for several years to William Fiennes, first Viscount Saye and Sele, and to George, eighth Lord Berkeley, he improved his social position by becoming chaplain to a nephew of King Charles I, Charles Louis, Prince Elector Palatine, who was then in England. He is said to have been appointed to this position because of his knowledge of mathematics which – along with an interest in science – he acquired during his leisure hours as a student.

¹ *D. N. B.*, art. "John Wilkins." In his biographical sketch of Wilkins in *Brief Lives*. Edited from the *Original Manuscripts and with a life of John Aubrey*, ed. Oliver L. Dick (Ann Arbor, 1957), John Aubrey suggests that many of Wilkins' professional advances were made through the influence of friends.

In connection with his chaplaincy to the prince he may also have made a trip to Heidelberg, probably soon after the peace of Westphalia.²

Wilkins qualified for the B. D. degree in 1648 (and in 1649 for the D. D.) and in the same year was appointed Warden of Wadham College, Oxford. The college flourished under his direction, and counted among its graduates such notables as the architect and anatomist, Christopher Wren (1634–1723); the astronomer and Bishop of Salisbury, Seth Ward (1617–1689); the historian of the Royal Society, Thomas Sprat (1635–1713); and the Bishop of Oxford, Samuel Parker (1640–1688). During his wardenship he took an active interest in the affairs of the University and, having sided with the Parliamentarians in the Civil War, was appointed with four others by Cromwell, whose widowed sister he had married,³ to execute the office of chancellor. In 1659 he was appointed by Richard Cromwell to the presidency of Trinity College, Cambridge, a position lost the following year with the restoration to power of Charles II.

After his expulsion from Trinity – over the objection of all the fellows of the College – Wilkins began to rise in the Church. He conformed immediately to the Church of England and in the same year received two appointments. The major positions he held were as Dean of Ripon (1660–1662); Vicar of St. Lawrence Jewry Church in London (1663–1668), a position obtained through the influence of his friend Seth Ward; and Bishop of Chester (1668–1672), which, having acquired through the friendship of George Villiers, the Duke of Buckingham, he kept until his death. During the late 1660's he was a member with his friend, John Locke,⁴ of a commission for the comprehension into the Church of England of the more moderate dissenters and for toleration of the extremists; however, because of opposition from conservatives in the Anglican Church the program failed.

² Aubrey, *loc. cit.* In a letter to Robert Boyle dated 16 September 1658, Samuel Hartlib comments on Wilkins' having been across the sea. The letter is in *The Works of the Honourable Robert Boyle*, ed. Thomas Birch, 6 vols. (London, 1772), VI, 115. Anthony à Wood, in his *Athenae Oxoniensis*, notes that Wilkins had seen the Prince of Orange's Court at the Hague on his way to and on his way from Heidelberg (III, col. 971).

³ In 1656 Wilkins married Regina French, Cromwell's widowed sister, after receiving a special dispensation from the Protectorate since by University statute wardens were not allowed to marry. The Royalist poet John Evelyn, who speaks of Wilkins as "my excellent & deare Friende," notes further that though Wilkins was a "most obliging Person ... [he] had married the *Protector's* sister, to preserve the *Universities* from the ignorant Sacrilegious Commander and Souldiers, who would have faine ben at demolishing all both places & persons that pretended to Learning" (*The Diary of John Evelyn*, ed. E. S. de Beer, 6 vols. (Oxford, 1955), entry for 10 July 1654, II, 106 and entry for 10 February 1656, III, 165).

⁴ Maurice Cranston, *John Locke, A Biography* (New York, 1957), p. 39 and H. R. Fox Bourne, *The Life of John Locke*, 3 vols. (New York, 1876), I, 309.

During the last year of his life Wilkins suffered from kidney stones. In his *Diary* Robert Hooke (1635–1703) presents a graphic account of the last week:

Nov. 13: At Lord Chesters ill of the stone; Nov. 16: Lord Chester desperately ill of the stone ... oyster shells ... 4 red hot quenched in cyder a quart and drank, advised by Glanvill ...; Nov. 19: Lord Bishop of Chester died about nine in the morning; Nov. 20: Supd at Kings head with Society. Dr. Needham brought in account of Lord Chesters having no stoppage in his uriners nor defect in his kidneys. There was only found 2 small stones in one kidney and some little gravell in one uriter but neither big enough to stop the water. Twas believed his opiates and some other medicines killed him, there being no visible cause of his death. He died very quickly and with little pain, lament of all.⁵

Thus ended the life of “this incomparable man, the most universally beloved of all that knew him,”⁶ a victim of the cause to which he devoted his life’s energies.

Of primary importance in Wilkins’ life was his interest in science. Though not of the stature of such of his friends as Robert Hooke, Robert Boyle (1627–1691), John Wallis (1616–1703), and Isaac Barrow (1630–1677) – no great discoveries or inventions are associated with his name – he nonetheless had a keen interest in several of the particular sciences and was instrumental in the founding of the Royal Society. As the interests of the great scientists shifted so did his, from Copernican astronomy and Galilean mechanics in his earlier years to the phenomena of the microscope as discovered by Wren and Hooke, and then to the biological sciences in his later years. He is credited with a variety of minor inventions, such as a glass apiary, a way-wiser (odometer), a hollow statue with a speaking tube, a thermometer, and a machine to sow grain; and with projects for many more, such as submarine navigation, wind propelled carriages, flying machines, new rigging for ships, springs for carriages, “a wheel for one to run races in,” and others. The poet Evelyn, upon seeing Wilkins, Hooke, and Sir William Petty (1623–1678) engaged in an experiment, observed in his *Diary* that “perhaps three such persons were not to be found elsewhere in Europe, for parts and ingenuity.”⁷

Even more important than his role as an amateur scientist was Wilkins’ association with the Royal Society; one of his biographers notes that “he deserves, more than any other man, to be esteemed the founder of the Royal Society.”⁸ Though the series of events leading

⁵ Robert Hooke, *The Diary of Robert Hooke*, 1672–1680 (London, 1935), pp. 13–14.

⁶ Evelyn, entry for 14 November 1668, III, 518.

⁷ *Ibid.*, entry for 7 September 1655, III, 416.

⁸ *D. N. B.*, art. “John Wilkins.” For extended and varied accounts of Wilkins’ role in the founding of the Royal Society see the following studies; Martha Ornstein, *The Role of the*

to the founding of the Royal Society is more complex than can be detailed here, it is known that scientific meetings were attended by Wilkins in London as early as 1645 at the lodgings of Dr. Jonathan Goddard (1617?-1675). According to Wallis' familiar account the meetings were held

at a certain day and hour, under a certain Penalty, and a weekly Contribution for the Charge of Experiments, with certain Rules agreed upon amongst us. Where (to avoid diversion to other discourses, and for some other reasons) we barred all Discourses of Divinity, of State-Affairs, and of News (other than what concern'd our business of Philosophy) confining ourselves to Philosophical Inquiries, and such as related thereunto; as Physick, Anatomy, Geometry, Astronomy, Navigation, Statics, Mechanicks, and Natural Experiments ...⁹

There are no record books for the early period, though by á Wood's account the early meetings were held not "as a foundation for a Society but merely for diversion sake in an innocent and virtuous manner."¹⁰

When he took up his duties at Wadham in 1649 Wilkins and several new friends, together with some of the London group who had moved to Oxford, began a new series of meetings, those at London continuing with the members there. In the new group were such men as Ward, Petty, Wallis, Goddard, Wren, and Sprat. By the personal invitation of Wilkins, Robert Boyle came to Oxford and associated with the group.¹¹ Aubrey writes of Wilkins that he was the "Principall Reviver of Experimentall Philosophy at Oxford, where he had weekly an experimentall philosophical Clubbe, which began 1649, and which was the *Incunabula* of the Royall Society."¹² At this time the purpose of the group seems to have changed; the meetings were not held merely for the sake of diversion but definite plans were being laid for the establishing of a society and statutes governing the order of the meetings were drawn up.

Soon after Wilkins was appointed to the presidency of Trinity College in 1659, formal meetings were discontinued at Oxford though private research continued. Soon after his expulsion from Cambridge (he had been there only eleven months) and his return to London, meetings

Scientific Societies in the Seventeenth Century (Chicago, 1928), especially Chapter IV; Dorothy Stimson, "Dr. Wilkins and the Royal Society," *The Journal of Modern History*, III (1931), 539-563; Harcourt Brown, *Scientific Organizations in Seventeenth Century France* (Baltimore, 1934), especially Chapter V; and *The Record of the Royal Society* (London, 1940), especially Chapter I.

⁹ John Wallis, *A Defence of the Royal Society, And the Philosophical Transactions, Particularly those of July, 1670. In Answer to the Cavils of Dr. William Holder* (London, 1678), p. 7.

¹⁰ Anthony á Wood, *History and Antiquities of Oxford*, II, ii, 632-633, quoted on p. 545 of Stimson's "Dr. Wilkins and the Royal Society," mentioned in fn. 8 above.

¹¹ Boyle, *Works*, VI, 633-634, the letter from Wilkins to Boyle dated 6 September 1653.

¹² Aubrey, *Brief Lives*, art. "John Wilkins."

were resumed at Gresham College, many of the Oxford group having returned there. At the meeting of 28 November 1660, over which Wilkins presided, formal action was taken to establish a society. Within two weeks the king's approval was secured, and two years later, on 15 July 1662, the Great Seal was affixed to the Charter. Wilkins was elected one of the two secretaries and remained active in the Society for the rest of his life. He helped draw up the statutes and a revised charter, and served on a variety of committees as well as on the general council until his death in 1672. His work during the period of his association with the Society was so intense that Hooke could write of him in the preface to his *Micrographia*: "there is scarce any one Invention, which this Nation has produc'd in our Age, but it has some way or other been set forward by his assistance ... He is indeed a man born for the good of mankind, and for the honour of his Country."¹³

Most of Wilkins' publications in science were written early in his life. None contained any new scientific laws or theories, and, though popular in his own time, are hardly known today. But insofar as they suggest elements of the theory he developed later, a brief survey of some of them may be justified. In 1638 he published his first work, *Discovery of a New World*,¹⁴ and two years later, *A Discourse Concerning a New Planet*,¹⁵ the one a defense and popularization of Copernican astronomy, the other an attack on scriptural literalism concerning astronomical matters. In the first essay, which Grant McColley has shown to be based upon Campanella's *Apologia pro Galileo*,¹⁶ Wilkins attempts to show that the heliocentric view is conformable both to reason and scripture; he therefore attacks both the Aristotelian principles upon which the geocentric theory is based and the Biblical literalism which hindered the reception in his own time of Copernicus' views. What he

¹³ Robert Hooke, *Micrographia: or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses, with Observations and Inquiries thereupon* (London, 1665), Preface. A facsimile edition of this appears as Vol. XIII of R. T. Gunther, *Early Science in Oxford*, 14 vols. (Oxford, 1923-1928).

¹⁴ John Wilkins, *Discovery of a New World; or a Discourse tending to prove, That ('tis probable) there may be another Habitable World in the Moon* (London, 1638). Reference to this work will be from a collection of some of Wilkins' early works, *The Mathematical and Philosophical Works of the Right Reverend John Wilkins, Late Lord Bishop of Chester* (London, 1708). *The Discovery of a New World* went through at least five editions before being published as the first part of the collection, the fifth appearing in 1684.

¹⁵ John Wilkins, *A Discourse Concerning a New Planet: Tending to prove, That ('tis probable) our Earth is one of the Planets* (London, 1640). The edition here used is that in the *Mathematical and Philosophical Works* cited above.

¹⁶ Grant McColley, "The Debt of Bishop John Wilkins to the *Apologia pro Galileo* of Tommaso Campanella," *Annals of Science*, IV (1939), 150-168. McColley has also published a translation of Campanella's *Defense of Galileo* in *Smith College Studies in History*, XXII (1937), i-xliv and 1-89.

attempts to prove is that the moon, like the earth, is a habitable planet.¹⁷ Toward the end of the essay he takes up the question of the nature of life on the moon, speculating what it might be like by citing authorities.

The *Discourse Concerning a New Planet* is a reply to an essay published in 1634 by Alexander Ross (1590–1654) entitled, *Commentum de terrae motu*,¹⁸ which was an attack on Copernican astronomy. Ross, a Southampton school teacher, was a strict Aristotelian in science and a literalist in Biblical interpretation. In his book he represents belief in the motion of the earth as a product of a superstitious mind. His main argument is that since it is true in scripture that the sun moves and the earth stands still the Copernican astronomy must be false; were the astronomical account true one would have to charge scripture and God with deceit.

Wilkins' reply to these arguments in the *Discourse Concerning a New Planet* is basically similar to his defense of the moon's habitability in the *Discovery of a New World*. Since theological truths are to be distinguished from scientific ones in that the former are based on divine authority and the latter on human experience and reason, and since human experience is varied and changing, the strangeness of the belief in the earth's motion is no argument against its truth. The Biblical writers probably were ignorant of the workings of nature; their inspiration extended only to matters essential to religious belief.¹⁹ He argues further that so far as scripture is concerned, if correctly interpreted, there are no texts which warrant belief in the diurnal motions of the heavenly bodies and that the ancient Church Fathers were simply mistaken when they interpreted them in that fashion. Since the

¹⁷ The doctrine of the moon's habitability was not an innovation on Wilkins' part. In his "The Seventeenth Century Doctrine of a Plurality of Worlds," *Annals of Science*, I (1936), 385–430, McColley traces the idea to its origins in Greek thought and examines its use in the modern period. See also Marjorie H. Nicolson, "A World in the Moon, A Study of the Changing Attitude Toward the Moon in the Seventeenth and Eighteenth Centuries," *Smith College Studies in Modern Languages*, XVII (1936), 1–72 and her *Voyages to the Moon* (New York, 1948).

¹⁸ Alexander Ross, *Commentum de terrae motu circulari* (London, 1633). From the report of this book given by McColley in "The Ross-Wilkins Controversy," *Annals of Science*, III (1938), 153–189, the arguments used are similar to those in his *The New Planet no Planet; or, the Earth no wandring Star, Except in the Wandring Heads of Galileans ...* (London, 1646), which was written in reply to Wilkins' second book. McColley's article examines at some length the arguments of the controversy and the milieu out of which it grew.

¹⁹ *Discourse Concerning a New Planet*, pp. 143–148. See also in this connection Dorothy Stimson, *The Gradual Acceptance of the Copernican Theory of the Universe* (New York, 1917). For an account of the relation between faith and reason as it developed in Wilkins' thought and in the minds of the virtuosi of seventeenth century England in general, see Richard S. Westfall, *Science and Religion in Seventeenth Century England* (New Haven, 1958).

Scriptures nowhere affirm the immobility of the earth, argues Wilkins, and since there are no proofs against the sun's being the center of the universe, it is probable that the earth does move.

During the year following the publication of the *Discourse Concerning a New Planet*, Wilkins published his *Mercury, or the Secret and Swift Messenger*,²⁰ a study in cryptography and of several mechanical devices for secretly communicating messages great distances. Of special importance is the last chapter in which mention is made of a "universal character that may be legible to all nations and languages," which indicates his interest in a universal scientific language some twenty-five years before the publication of his *Essay towards a Real Character and Philosophical Language*.²¹ Inspired by the idea that in mathematics and chemistry there is a symbolism that is universally understood, Wilkins proposed to construct an artificial language to enable scientists the world over to communicate their discoveries to one another. He was commissioned by the Royal Society in 1662 to produce the work,²² and did so with the aid of his friends John Ray and Francis Willoughby to help classify the animal and plant worlds into species, and his former student William Lloyd to draw up a dictionary and correlate the tables of classification to it. Wilkins himself, Wallis reports, did not expect the scientific language to gain universal acclaim or use, but was interested in showing only that such a language was a real possibility.²³

In the year prior to his election to the wardenship of Wadham another of his interests found expression in the publication, *Mathematical Magick*.²⁴ Composed, like most of his earlier works, during his school days, this book is claimed by its author to be a treatise "con-

²⁰ John Wilkins, *Mercury; or, the Secret and Swift Messenger; Showing how a Man with Privacy and Speed can communicate his Thought to his Friend at any Distance* (London, 1641). The edition used is that in the *Mathematical and Philosophical Works*.

²¹ John Wilkins, *Essay towards a Real Character and a Philosophical Language* (London, 1668). An outline of such a language also appears in a book by one of Wilkins' Wadham students, Seth Ward's *Vindiciae Academicarum* (Oxford, 1654), pp. 19-24.

²² The Society appointed a commission to report on the book after it was completed, but there is no record of the report. One critic of the *Real Character* was Leibnitz, who, being in England in 1673, "told both Mr. Boyle and Mr. Oldenburgh, that he did not think either Dr. Wilkins or Dalgarno had come to the point. They might indeed enable nations who did not understand each other to correspond easily together, but they had not obtained the real character, which would be the best instrument of the human mind, and extremely assist both the reason and memory, and the invention of things. These characters ought to resemble as much as possible those of algebra, which are very simple and expressive, and are never superfluous or equivocal, but whose varieties are grounded on reason" (*Biographia Britannica: or the Lives of the most eminent Persons who have Flourished in Great Britain and Ireland*, 6 vols. (London, 1766), VI, Part II, 4273, note S).

²³ Wallis, p. 17.

²⁴ John Wilkins, *Mathematical Magick; or, the Wonders that may be performed by Mechanical Geometry* (London, 1640). The edition used is that in the *Mathematical and Philosophical Works*.

cerning mechanical powers and motions, Being one of the most easie, pleasant, useful (and yet most neglected) part[s] of Mathematicks. Not before treated of in this language." *Mathematical Magick* is divided into two books, the first dealing with statics, the second with dynamics. In the first he explains the principles of the balance, lever, wheel, pulley, wedge, and screw, and shows how, if one had the machinery, one could lift the earth with a lever, lift any conceivable weight by a system of cogged wheels, or uproot an oak tree with the force of one's breath applied to the proper combination of wheels, pulleys, and levers. The second book is concerned with the application of these principles to machinery of one sort or another – mills, clocks, sail driven chariots, mechanical animals, submarine navigation, flying, and perpetual motion machines.

Wilkins' major work, the one we shall consider in detail for its statement of principles adopted in the theory of science, was published posthumously in 1675 from unfinished manuscripts by his stepson-in-law, John Tillotson. In this work, *Of the Principles and Duties of Natural Religion*,²⁵ an attempt is made to secure for religion a basis in reason so strong that it would be able to withstand any sort of attack. He intends "to Treat concerning the Reasonableness and Credibility of the Principles of *Natural Religion*, in opposition to that Humour of Scepticism and Infidelity which hath of late so much abounded in the World, not only amongst sensual men of the vulgar sort, but even amongst those who pretend to a more than ordinary measure of Wit and Learning."²⁶ In another presentation of his interests Wilkins indicates that actually there are two forces to be opposed, skepticism and dogmatism, each destructive of religion. He presents the essential features of each. On the one hand, "by *Scepticalness*, I mean, a willingness and inclination of mind, rather to comply with doubts and objections, than with proofs and evidences; an aptness to pick quarrels with every thing, the never so manifest, as if we were not willing that everything should be certain and established."²⁷ On the other hand, "By *Dogmaticalness*, I mean, a readiness to be overconfident of the things we are well inclined to;

²⁵ Tillotson states in the Preface that the first twelve chapters were ready for the printer at the time of the author's death, the rest requiring some editing. The book was first published in 1675 and was reprinted quite often during the next sixty-five years, editions appearing in 1678, 1683, 1693, 1694, 1699, 1715, 1722, and 1734. The edition used here is the London edition of 1699, and will be cited as *Natural Religion*.

²⁶ *Natural Religion*, p. 1.

²⁷ John Wilkins, *Sermons Preached Upon Several Occasions* (London, 1682), Sermon III, p. 87. The sermons were also edited by Tillotson.

an aptness to own every thing for equally true and certain ... without a particular enquiry into the grounds and reasons of things.”²⁸

In *Natural Religion* Wilkins' primary concern is to reject the latter and to outflank the former in order to obviate its objections against religion. He attempts to show that extreme skepticism is an absurdity; a serious adherence to it would soon put an end to religion and to life itself. He is not willing, as was Descartes, to reject everything for which the conditions of falsity can be stated; such skepticism leads to nihilism and is therefore rejected as absurd. Wilkins admits at the outset that the world is fundamentally irrational in the sense that reality cannot be completely understood by the finite human understanding but does not take this to be a cause for practical despair. In their daily and practical affairs people do claim certainty and base it upon evidence. Wilkins seeks to discover what kinds of certainty there are together with the corresponding levels of evidence. His strategy in the enterprise of securing natural religion is to found it upon the nature and reason of man, thereby to secure it against attacks from the same source. Specifically, he attempts to prove God's existence, to make out clearly God's nature and attributes, and determine what attitudes and behavior one ought to exhibit toward God and one's fellowmen.

Insofar as our concern is with the problem of certainty rather than with the foundations of natural religion, we shall for the most part neglect Wilkins' specific program as outlined above and confine ourselves to the more philosophical aspects of his book. He recognizes that before he can proceed with his major enterprise certain foundations must be laid: he finds it necessary to investigate the various kinds and degrees of evidence and assent, and to establish a set of postulates concerning their inter-relation. These principles, together with a set of moral postulates,²⁹ are presented in the opening chapters of the book and are specifically limited in their applicability to such knowledge or belief as is not based upon revelation.

Wilkins' views can most easily be understood by first classifying the several kinds of assent he recognizes, and then examining each in relation to the evidence to which it is properly correlated. In one scheme of classification, a scheme also used by Glanvill and later by Locke, two kinds of assent are distinguished: on the one hand, "That

²⁸ *Ibid.*, p. 88.

²⁹ At the beginning of his presentation of the moral postulates Wilkins makes a marginal reference to Henry More. The postulates seem to be from More's *Enchiridion Ethicum*, first published in 1666. See *Enchiridion Ethicum. The English Translation of 1690 Reproduced from the First Edition* (New York, 1930), pp. 20-27.

kind of *Assent* which doth arise from such plain and clear Evidence as doth not admit of any reasonable cause of doubting, is called *Knowledge* or *Certainty*;"³⁰ and on the other, "That kind of Assent which doth arise from such evidence as is less plain and clear, is called *Opinion* and *Probability*."³¹ Where the evidence is such as to warrant neither affirmation nor denial there is simply hesitation or suspension of judgment. Within the first of these, three sub-classifications are made: physical, mathematical, and moral certainty. On another scheme of classification, which uses Chillingworth's terminology, Wilkins distinguishes three levels of certainty: absolutely infallible certainty, conditionally infallible certainty, and indubitable certainty.³² The first is a prerogative of God, it being one of his incommunicable attributes. The second comprehends both physical and mathematical certainty and is the greatest humanly possible (revelation possibly excepted). Such certainty requires for its occurrence fulfillment of two requirements, that "our faculties be true, and that we do not neglect the exerting of them."³³ The fulfillment of the first of these conditions Wilkins simply sets down as a postulate without which knowledge is impossible, "and upon such a supposition there is a necessity that some things must be so as we apprehend them, and that they cannot possibly be otherwise."³⁴ Indubitable certainty, which is the same as moral certainty, is not as strong as infallible certainty for, although the same suppositions are made, the evidence is less strong and thus provides only an assurance "which doth not admit of any reasonable cause of doubting."³⁵

Given this classificatory account of the kinds and levels of certainty or assent, the nature of each will become more evident upon detailed examination of the evidence to which each is to be correlated. In describing the kinds and sources of evidence the Bishop of Chester attempts to be as precise as possible and so provides definitions for most of the crucial terms, though his meanings are not always clear. He begins with the senses: "By Senses I mean those *Faculties* whereby we are enabled to discern and know such *particular* Objects as are *present*."³⁶

³⁰ *Natural Religion*, p. 5. It should be noted, however, that although Locke uses the same terminology as does Wilkins, the meanings he gives to 'knowledge' and 'probability' are somewhat different.

³¹ *Ibid.*, p. 11.

³² *Ibid.*, p. 9.

³³ *Ibid.*

³⁴ *Ibid.*

³⁵ *Ibid.*

³⁶ *Ibid.*, p. 3. In his *Real Character* Wilkins also provides definitions of the several faculties or powers of the mind; insofar as they elucidate the account given in the major work we

The senses are of two kinds, external and internal. The "outward senses," naturally enough, are those "by which we apprehend *external* Objects, as when we see, or hear, or touch any thing presented to us." ³⁷ The "inward senses" are a complex source of evidence: by them one is, first, conscious of himself; second, conscious or aware of the impressions made on the senses and of such inward "motions of the mind" as its apprehensions, inclinations, and power of self-determination; and, finally, assured of what he thinks, desires, or purposes.³⁸ Such evidence produces the highest kind of certainty of which man is capable, physical certainty. About this kind of evidence and the corresponding assent he says: "Nothing can be more manifest and plain to me, than that I now see somewhat which hath the appearance of such a colour or figure, than that I have in my mind such a thought, or purpose, and do feel within myself a certain power of determining my own actions, which is called *Liberty*." ³⁹

In his 1638 publication, *Discovery of a New World*, an important role is given the senses. In discussing the nature of life on the moon, Wilkins states but does not develop the thesis that all knowledge comes from the senses: "Our understandings [are] capable only of such things as have entered by our Senses, or else such mixed Natures as may be composed from them." ⁴⁰ In the same treatise, however, in replying to objections brought against the Copernican view that the stars are at an immense distance from the earth, he admits that the evidence of the external senses is not completely trustworthy since the soundness of the sense organ and variations in the conditions of the medium, distance, and so

shall refer to them in the appropriate footnote. He recognizes that there is a problem concerning the reality of the faculties but is unwilling to commit himself openly to their reality. He remarks in the *Real Character*: "Whether there be any such real Faculties in the Soul, as are mentioned under this [internal sense] and the preceding Head [rational faculties], is not here to be debated. 'Tis sufficient that common experience doth acquaint us with such operations of the Mind, and that general custom hath agreed upon such names for the expressing of them" (p. 196).

³⁷ *Natural Religion*, p. 3. It is difficult to determine precisely what Wilkins means when he speaks of the objects of sense perception. In the major work he speaks of perceiving both things and qualities; in the *Real Character*, however, in his exposition of sensible quality, he regards colors, tastes, and so on, as the proper objects of perception, where by sensible quality is meant "such kind of Quality as falls under our outward Senses, or the Affections of Bodies, considered as the Objects of Sense" (p. 214).

³⁸ *Natural Religion*, p. 3. The presentation in the *Real Character* is more schematic: "INTERNAL SENSES are so styled because they belong to the *interiour parts*, and are conversant about internal and *absent* as well, as present things" (p. 196). The internal senses are of two kinds, apprehensive and motive. The former are such powers as common sense by which perceptions are received from the external senses, the fancy by which perceptions are combined and compared, and memory. The motive powers are appetite and loathing, by which for our own conservation we follow or flee what is judged to be good or evil.

³⁹ *Natural Religion*, pp. 5-6.

⁴⁰ *Discovery of a New World*, p. 106.

on, might affect perception. Thus the senses are the source of the highest certainty, but are not absolutely infallible.

The account given in the posthumous work differs from this in some detail. Here he first states that sense perception belongs both to man and the brutes. Since both possess similar sensory faculties the objects perceived are alike: "There is an universal agreement in the sensation of outward Objects; The *Eye* and the *Ear* of all sensitive Creatures, having the same kind of perception of *visible* and *audible* things. Those things which appear Green, Blew, or Red to one, having the same appearance to all others."⁴¹ Wilkins admits that he does not understand how the senses – both external and internal – operate, but claims this is no argument against the genuineness of the knowledge derived from them. The manner of sense perception is one thing, the results another, and difficulties about one do not bode ill for the other. In spite of this nescience concerning the manner of their operation, he claims that the greatest certainty one can have, physical certainty, is based upon such evidence. In making this claim Wilkins exhibits a stronger empiricism than either of his friends, Henry More or Joseph Glanvill, for whereas they give special priority to mathematics, he, as did Tillotson, emphasizes the role of the senses.

The second kind of evidence he considers relates to the understanding and arises either from the nature of things themselves or from testimony. By the understanding is meant the faculty by which one can "apprehend the objects of Knowledge, *Generals* as well as *Particulars*, *Absent* things as well as *Present*; and to judge of their *Truth* or *Falsehood*, *Good* or *Evil*."⁴² With respect to the objects so apprehended the mind performs three functions: there is simple apprehension, the "perception of such simple objects as are proposed to [it];" judgment, the "putting together [of] such single objects, in order to our comparing the Agreement or disagreement betwixt them, by which we make Propositions;" and the inferring of propositions from one another.⁴³ Of the two kinds of evidence in which these mental functions are involved the former is the more difficult to understand. Evidence arises from the nature of things "when there is such a Congruity or Incongruity betwixt the *Terms* of a

⁴¹ *Natural Religion*, pp. 56–57. In the *Real Character* the same principle is stated with respect to concepts: "As men generally do agree in the same Principle of Reason so do they likewise agree in the same *Internal Notion* or *Apprehension of Things* ... That *conceit* which men have in their minds concerning a Horse or Tree, is the *Notion* or *Mental Image* of that Beast, or natural thing, of such a nature, shape, and use" (p. 20). This assumption is the basis for his universal language.

⁴² *Natural Religion*, p. 4.

⁴³ *Ibid.*, p. 56.

Proposition, or the *Deduction* of one Proposition from another, as doth either satisfy the mind, or else leave it in doubt and hesitation about them.”⁴⁴ In considering this kind of evidence we shall consider first how it gives rise to mathematical certainty, what it is, and then its relation to moral certainty.

Such evidence as arises from the nature of things gives rise to both mathematical and moral certainty. Mathematical certainty follows physical certainty in rank and is the kind of certainty one has of the propositions and demonstrations of mathematics and other abstract sciences whose “natures do lie so open, and are so obvious to the understanding” that assent is immediately forthcoming. Such certainty is characterized by the two features that assent is forced and denial of the proposition (or demonstration) involves a contradiction. Upon knowing the meanings of the terms involved no one could deny that the whole is greater than the part, that three and three are six, or that four is more than three. Such propositions carry with them their own evidence, and need no verification from sense observations, testimony, or other source. They are self-evident. There is operative here what Wilkins calls “natural necessity;” one could no more deny this sort of proposition (or deductions from them) than he could avoid feeling hunger or sleepiness. One has no option to give or withhold assent; compliance is forced. Denial of such propositions would be self-contradictory for it would be to deny meanings already accepted. Such certainty, however, requires the assumption, already mentioned, that the faculties are true. This he sets down, as did his friend Henry More, as a postulate.⁴⁵ Having made it, he claims that no one, “though never

⁴⁴ *Ibid.*, p. 4.

⁴⁵ Unlike Tillotson, who tried to give a Cartesian justification in terms of the goodness and veracity of God for the principle that the senses do not always deceive, Wilkins and More simply make it a postulate. In the preface to his *Antidote Against Atheism* More writes: “Wherefore I have endeavored to insist upon such [arguments] alone, as are not only true in themselves, but are unavoidable to my Adversary ... if he will with us admit of this one *Postulate* or *Hypothesis*, that our *Faculties* are true.”

There are more of his ideas which also appear in the writings of Wilkins and his contemporaries, showing the ubiquity in English thought of the tradition we are examining. One point he makes is that the bare possibility of error is not itself a sufficient basis for rejecting a particular claim as false. Such arguments as there are for God’s existence, for example, are not such as to exclude all possibility that God does not exist, but the possibility alone is not a sufficient ground for withholding assent. As a corollary More considers the complementary case of falsity, that the possibility of something’s being true is a sufficient ground to forestall declaration of its falsity: “For if the bare possibility may at all entangle our assent or dissent in things, we cannot disbelieve the absurdest Fable in Aesop or Ovid, or the most ridiculous figments that can be imagin’d; *As suppose that Ears of Corn in the fields hear the whistling of the wind or the chirping of the birds, that the stones in the street are grinded with pain when the Carts go over them...*” (p. 39).

so much prejudiced ... though never so much addicted to Paradoxes," could deny the above sorts of propositions:

There is such a kind of Connexion betwixt the Terms of some Propositions, and some Deductions are so necessary as must unavoidably enforce our assent. There being an evident necessity that some things must be so, or not so, according as they are affirmed or denied to be, and that supposing our faculties to be true, they cannot possibly be otherwise, without implying a contradiction.⁴⁶

One point that should be made concerning evidence from the nature of things, before turning to the moral certainty to which it also gives rise, is the suggested psychological factor involved. In both the recognition of the connection between terms of propositions and between propositions, the perceived connection must be such as to "satisfy the mind." If Wilkins' language can be taken at face value here, it seems that the ultimate basis of reasoning and judgment is a psychological feeling, a motif noted earlier in Tillotson's writings.

Evidence from the nature of things sometimes gives rise to a kind of certainty less than physical or mathematical, namely indubitable or moral certainty. This is the assurance one has of anything for which there remains no ground for a "reasonable doubt." Assent is not forced but freely given, and will be given by any reasonable person free from prejudice: "And though there be no natural necessity, that some things must be so, and they cannot possibly be otherwise, without implying a contradiction; yet may they be so certain as not to admit any reasonable doubt concerning them."⁴⁷ Of the three kinds of certainty this is the most important since of most things said to be known one can at best be only morally certain. It should be noted that the differentiating feature of this kind of certainty – the absence of a reasonable doubt – is also made the basis of Wilkins' minimal definition of knowledge: "That kind of *Assent* which doth arise from such plain and clear Evidence as doth not admit any reasonable cause of doubting, is called *Knowledge* or *Certainty*."⁴⁸

In making reasonable doubt the distinguishing feature of moral certainty Wilkins is making an appeal to common sense. In the context of religion in which he is writing, the skeptic is unreasonable in making the bare possibility of doubt a sufficient reason for withholding assent, and the dogmatist is likewise unreasonable in demanding a kind of evidence not open to any doubt whatever. If a normal, rational person

⁴⁶ *Natural Religion*, p. 7.

⁴⁷ *Ibid.*, p. 8.

⁴⁸ *Ibid.*, p. 5.

upon careful consideration of the evidence is persuaded of the truth of, say, a religious doctrine, then there is no just cause for regarding it as uncertain, i.e., there is no reasonable doubt of its truth. The concept of reasonable doubt has, since Wilkins' time, and perhaps on account of him, become an important part of legal theory. If jurors, upon careful consideration of testimony, find no reasonable doubt of or no just cause for doubting the guilt of the accused, they are to find him guilty, otherwise not.⁴⁹

The principle of reasonable doubt leaves open the possibility that what has been proved may be otherwise than the evidence indicated; however, this is not a sufficient ground for withholding assent.⁵⁰ The possibility of error does not argue a strong probability that it has occurred, hence in no way affects certainty. No one doubts who his parents are, nor whether he was baptized, and yet the evidence for such beliefs can be erroneous. "Who is there so wildly Sceptical as to question," asks Wilkins, using Tillotson's examples, "whether the Sun shall rise in the East, and not in the North or West, or whether it shall rise at all?"⁵¹ No one would doubt that pieces of metal with the inscription of a Roman emperor found in the ruins of a city were coins (the example is More's) rather than products of natural forces, even though it is possible they are.

He that will raise to himself, and cherish in his own mind, any real Doubts, according to the meer possibility of things, shall not be able to determine himself to the Belief or Practice of any thing. He must not stay within Doors, for fear the House should fall upon him, for that is possible; nor must he go out, lest the next man that meets him should kill him, for that also is possible: And so must it be for his doing or forbearing any other Action.⁵²

This acquiescence in a certainty less than infallible Wilkins thinks is a principle so strong in human nature that if it were otherwise reason would be a torment to mankind. Men would soon be driven to insanity if the mere possibility of something were a basis upon which to establish either hope or fear.

Moral assurance occurs in the affairs of daily life as well as in such disciplines as morals, politics, history, and science. The merchant

⁴⁹ For an historical investigation of the role of the concept of reasonable doubt in legal theory see Theodore Waldman, "Origins of the Legal Doctrine of Reasonable Doubt," *The Journal of the History of Ideas*, XX (1959), 299-316.

⁵⁰ *Natural Religion*, pp. 7-8 and 26. Wilkins held this view as early as the publication of his *Discovery of a New World*, though it was limited there to the evidence of sense perception (p. 96).

⁵¹ *Natural Religion*, pp. 27-28. The source is Tillotson's sermon, "The Wisdom of Being Religious."

⁵² *Natural Religion*, p. 29. The examples used here are also from Tillotson's sermon mentioned in the previous footnote.

invests in foreign business enterprises only because he feels certain of a profitable return; the general goes to battle only because he is certain of victory. One fundamental thesis of *Natural Religion* is that in religion this is the only kind of certainty that can reasonably be demanded of any proof of God's existence or of his attributes. The fundamentals of religion, so far as can be determined, are not such that their denial leads to contradiction, i.e., are not infallibly true, nor are they so uncertain as to warrant rejection. Just as one is certain beyond a reasonable doubt in the affairs of daily life and in the sciences, so one can be certain in religion.

The evidence giving rise to moral certainty is from the nature of the thing, from testimony, or from experience. From evidence from the nature of things one knows, for example, that a mind free from prejudice is better qualified to make sound judgments than one that is not free, that men are by nature destined for a social life, and that there are such things as virtue and vice. In the chapter of *Natural Religion* in which he attempts to prove God's existence from the origin of the world, evidence from the nature of things is used to show that the world is finite in its temporality. He argues against the Aristotelian view of the eternity of the world that if the world were older than is recorded in Moses' historical account, there would have remained some written record of it, but since there is no such record the world cannot be older than is consistent with Moses' account. Also, the relative underdevelopment of the sciences argues for the temporal finiteness of the world since it is unimaginable that men should have lived for an infinity of ages without them. Finally, if the world were eternal the fact of its being so sparsely inhabited would be inexplicable; it is only in the past two hundred years that much of it has even been discovered. Wars, floods, and famines cannot account for the devastation of populations since if these occurred at random all men could as well have been destroyed, and if they happened according to a plan there must have been a regulating agent – the point in question. The evidence from the nature of things here seems simply to be the reasoning from accepted premises in defense of a thesis. It is from the nature of things insofar as the premises are true of historical and geographical facts. So long as the reasoning from premises to conclusion is such as "doth satisfy the mind" rather than "leave it in doubt and hesitation" it would establish the creation of the world as morally certain.

A second kind of evidence of the understanding particularly relevant to the establishing of matters of fact which are beyond one's own

observations is testimony. The testimony of witnesses to a crime, of an explorer to the customs of far distant countries, or of an historian to events in the past, all establish acceptable truths, providing that the persons involved are authoritative and credible. What the criteria are by which authoritativeness and credibility are determined are not indicated, though some hints are given. In discussing a proof for God's existence he states that the books of Moses and the writings of certain of the Greek and Roman philosophers can be used as testimony on the ground that they are generally accepted as true. Further, in the *Discourse Concerning a New Planet* he suggests two negative criteria, namely, that what is believed by the unlearned multitude is not to be accepted as true simply because they believe it, and that competence in one field is insufficient ground for citing anyone as an authority in another area of knowledge.⁵³ From testimony one can be assured, at best only morally certain, using Wilkins' examples, that Queen Elizabeth was an historical person and that there is such a place as Spain. Similarly, one can learn some of the bases of religion only by testimony; e.g., the accounts of ancient writers are the only source of information of the person and activities of Christ and his disciples.

When the simple kinds of evidence – the reports of the external and internal senses, the nature of the thing itself and testimony – are combined one has mixed as distinct from simple evidence, evidence which depends on “our own observation and repeated trials of the Issues and Events of Actions or things, called Experience.”⁵⁴ Experience, like testimony and evidence from the nature of things, yields moral certainty. For example, one can be morally certain that night follows day and winter summer, and that the building one is in will not collapse within the next five minutes or be swallowed up by an earthquake.

Distinct from the three kinds of certainty – physical, mathematical, and moral – which are all classified as knowledge, is opinion or probability which is based upon such evidence as, because it results in a less clear conception, does not warrant the minimal moral certainty. Finally, where the evidence on both sides of a question is equal, suspension of judgment is warranted.

In laying the groundwork for his discussion of natural religion Wilkins proceeds, after considering the kinds of certainty and evidence, to establish more clearly their relationship; this he does “to prevent and

⁵³ *Discourse Concerning a New Planet*, p. 146.

⁵⁴ *Natural Religion*, pp. 4-5.

obviate the Cavils of Sceptical captious Men." In the first place, there are no degrees of truth. Taking a position similar to that of Chillingworth and Tillotson, he claims that all truths stand equal to one another for, quoting a maxim, "*Veritas non recipit magis & minus.*"⁵⁵ Such historical and geographical truths, says Wilkins, as that there was such a man as King Henry VIII and that there are such places as America and China may be as true as that we exist, we are awake, and that the sum of the angles in a triangle is equal to the sum of two right angles, though the same kind of evidence cannot be produced for each. This disparity in kinds of evidence is no warrant for regarding as uncertain such propositions as cannot be proved by the highest kind of evidence, i.e., by sense or self-evidence. To deny the truth of, say, an historical propositions because it cannot be verified immediately in sense experience would be as gross an error as to deny the existence of color because it is not heard.

The mistake lies in supposing that because all truths are on a par the evidence must be so too. Wilkins demurs, arguing as his second principle that "*Things of several kinds may admit and require several sorts of Proofs, all which may be good in their kind.*"⁵⁶ He cites in this connection, as did Tillotson, the early chapter of Aristotle's *Nicomachean Ethics*⁵⁷ where it is pointed out that because of differences in the nature of the things to be proved – whether it be a moral, physical, or metaphysical principle – the kind of evidence must be expected to differ. This principle is Wilkins' ultimate justification, as it was for Chillingworth and Tillotson, for accepting less than infallible certainty in religion and the sciences; so long as any proof is good in its kind and suited to its subject matter, confidence can be had in it:

No sober man can deny but that several things in *Moral*, and in *Natural Philosophy* are in themselves as absolutely, and as certainly true, and as firmly believ'd by us, as any *Mathematical Principle* or *Conclusion* can be. From whence I infer this, that it is not, ought not to be any prejudice to the truth or certainty of any thing, that it is not to be made out by such kind of proofs, of which the nature of that thing is not capable, provided it be capable of satisfactory proofs of another kind.⁵⁸

⁵⁵ *Ibid.*, p. 23.

⁵⁶ *Ibid.*

⁵⁷ It is quite likely that at this point in his writings Wilkins had in hand a copy of Grotius' *Truth of the Christian Religion*. When Grotius makes the point that less than infallible certainty is justifiable in matters of religion he does so by an appeal to Aristotle and makes explicit footnote reference to the *Nicomachean Ethics*, I, 3, and to the *Metaphysics*, I, 10 (*Truth of the Christian Religion*, p. 95, fn. 1). The latter passage has nothing to do with the particular problem nor with the general question of certainty. In *Natural Religion* (p. 23) Wilkins cites in the margin the same two passages. The coincidence suggests that Wilkins was really using Grotius as his source rather than Aristotle.

⁵⁸ *Natural Religion*, p. 25.

So far two things have been established, that there are no degrees of truth and that there is an objective relation between kinds of proof and things to be proved. The next step is that one ought to be satisfied with the best proof there is for a thing. The refusal to accept such a principle, the demand for the highest kind of evidence possible, i.e., observation or demonstration, in every situation, would reduce to almost nothing the realm of knowledge. If only that which is demonstratively proved could be accepted as genuine knowledge all history, for example, would have to be excluded from the domain of knowledge since there are no demonstrations of statements about the past and it is possible that all records might have been intentionally counterfeited.⁵⁹

In addition to his general comments on the relation between evidence and assent Wilkins considers specifically their connection in the context of religion. In matters of faith there is required only as much evidence as an honest person who is reasonable and teachable would need to sway his assent. Evidence so strong as to necessitate assent would destroy religion since there would be left no "place for the Virtue of *Believing*, or the freedom of our obedience."⁶⁰ This is so because reward and punishment are meaningful only when one acts voluntarily. There would be no merit in belief if assent were compelled. Before the principles of Christianity are accepted as beyond question, one must be "careful to preserve his mind free from Prejudice," and consider the evidence carefully. Religious belief thus demands that man be a free moral agent and rational.

There is a point however, at which the principle that assent must be proportioned to evidence breaks down; this is the case where the evidence on both sides of the balance is equal. Here, where one is intellectually at a standstill, one must govern his actions by what is to his interest and advantage. There is a psychological factor – a strong inclination for self-preservation and happiness – which compels one to accept the evidence for Christianity. Using the principle of the Pascalian wager (as did Tillotson) he points out the imprudence of choosing that course of action which is sure to be dangerous.⁶¹ To

⁵⁹ *Ibid.*, p. 26. The proportioning of assent holds not only in knowledge but also in matters of value. Wilkins states that "Honouring is properly an act of the understanding, in passing judgment upon the nature of things; When we do in our minds own and acknowledge the real worth or virtue of a thing or person. And everyone who will act rationally, not miscalling good evil, and evil good, must proportion his esteem of things, according to the real value of them. Nor is it in any man's power, so far to offer violence to his own faculties, as to believe any thing against evidence; to esteem that man to be either worthy or unworthy, whom he knows to be otherwise" (*Natural Religion*, pp. 362–363).

⁶⁰ *Ibid.*, p. 30; see also pp. 85–86.

⁶¹ *Ibid.*, pp. 37–38 and 97–98.

conclude his case Wilkins makes the stronger point that even if the arguments for one side "somewhat preponderate" over those for the other, and the side on which the evidence is the greater is the more hazardous to eternal happiness, the other ought to be chosen.

A general review of Wilkins' views will show that, as was the case with Chillingworth and Tillotson, he sees the world of knowledge as characterized by two extremes, absolute certainty and absolute skepticism. The first cannot be attained since it is a prerogative of God. The second is at all costs to be avoided, for acceptance of the "cavils of Sceptical captious Men" would put an end to the certainties of religion and science and the affairs of ordinary life, none of which Wilkins is willing to forego. The anti-skeptical theme is an important one in his book on religion. The position Wilkins formulates is similar to that of Chillingworth and Tillotson. All develop the view that between evidence and assent there is a proportionality, that as the evidence becomes stronger the belief can become more firm and assured. For all of them there are different kinds of evidence – of the senses, demonstration, and testimony – and levels of certainty ranging from nearly absolute certainty to mere probability. All justify the proportioning of assent to evidence on the Aristotelian principle that each kind of thing requires a particular kind of proof, and their willingness to settle for less than absolute certainty on his principle that it would be injudicious to demand a greater certainty than the case admits.

Another theme connected with the foregoing is an appeal to common sense. In the solution to many of the problems raised, Wilkins, as did Chillingworth and Tillotson, makes an appeal to what the man in the street believes, and makes this the standard by which to solve his problems; whatever is unacceptable to the common reasonable man is probably not true. This is shown in two ways. First, the examples used are drawn from the ordinary affairs of life: the report of a traveler about road conditions, of a merchant about foreign business, of an archaeologist about coins found in a ruins, and of the historian about past events. The certainty one has of their reports is taken as the prototype of the certainty that can be had of anything. "I appeal to the common judgment of mankind," says Wilkins. Second, the kind of certainty appealed to is that of the reasonable man. What an ordinary person, possessed of all faculties and judicious in his examination of evidence, would accept as true is for Wilkins the standard of truth. What is unacceptable to the reasonable man cannot stand philosophical scrutiny.

There are, however, certain tendencies developing in his position which are worth noting. Wilkins proposes that there is an objective relation between the situation and the evidence, and that one's degree of certainty is to be proportioned to the evidence. This should mean that one is more certain of a mathematical demonstration than of what is substantiated by testimony alone. However, this is not always the case for he claims that one is as certain of the conclusions of science and history as of a conclusion in mathematics, thus breaking down the objective relation supposedly existing between evidence and assent. So far as feelings are concerned there is no difference between the belief that there is such a place as Spain and that two plus two is equal to four; one is as certain of the former as of the latter. This being so, the distinction between the several degrees of certainty becomes less pronounced and the proportioning of assent to evidence becomes less significant. The next logical step is to divorce certainty from evidence altogether, as Hume did, but that is a subject for later consideration.

So far, the problem of certainty has been considered in the context of theological issues. In the instances of Chillingworth and Tillotson the particular context was that of the Rule of Faith controversy and atheism; in Wilkins an attempt was made to found religion upon reason. The views formally presented by Wilkins in his mature writings were expressed in rudimentary form in his early scientific writings, though not in the discovery of any scientific law. This is not to say, however, that he did not intend they should be so used. Considering his role as a founder of the Royal Society, it is inconceivable that he should have engaged in that enterprise without asking what the scientist could know of reality and what kind of certainty could be obtained in the sciences. It is conceivable and quite probable too, that he deeply influenced the formal program of the Society through his associations with such of its early members as Sprat, whose *History of the Royal Society* he probably read and approved before its publication; Boyle, whom he invited to Wadham College; and Glanvill, whose books show indications of familiarity with his early writings. Given Wilkins' role in the Society, his influence among its early members, his interest in the practical aspects of science, and his exposition of the theory of certainty we have been examining, one can conclude quite justifiably that in Wilkins there is the explicit recognition that the theory earlier developed by Chillingworth and Tillotson in the context of theological dispute is the theory which must be employed in the sciences if any significant progress is to occur. Indeed, this is Wilkins' message to his contempo-

raries and friends. It remains now, in the remainder of this chapter, to see how in the thought of Joseph Glanvill, a young friend of Wilkins, the theory of certainty found expression in the context of an apology for science rather than in the service of religion as it had heretofore.

SECTION II

JOSEPH GLANVILL

Joseph Glanvill's (1636-1680) outlook on life was influenced by several forces easily discernible in his environment.⁶² Born of Puritan parents in Plymouth county, he was unavoidably affected by strong Calvinism. This influence persisted at Oxford, where he took both his B. A. (1655) and his M. A. (1658), though there was some reaction against Puritanism at Lincoln College when he took the advanced degree. The reaction was strong enough to induce him to take orders in the Anglican Church in 1660. During the latter part of his stay at Oxford a study of Origen's doctrine of the soul developed into an interest in Henry More's Platonism. A correspondence flourished and the two men later collaborated on publications concerning witchcraft. A third influence on the young Glanvill was the scientific spirit of the Royal Society. Within several hundred yards of his own college the infant, unchartered society was meeting in the lodgings of the warden of Wadham College, John Wilkins. Whether Glanvill knew Wilkins personally or attended any of the meetings while in college is not known, but his first book, *The Vanity of Dogmatizing*,⁶³ contains obvious allusions to two of Wilkins' early works, *Discovery of a New World* and *Mercury; or, the Secret and Swift Messenger*.

Though by vocation a preacher Glanvill spent much time and energy in the affairs of science, working primarily on the theoretical rather than the practical side. As a preacher he held several positions, mostly without event, and even to the dislike of his parishoners. He was first a chaplain in the London home of the provost of Eton College, Francis Rous, a position held for six months. Soon after his ordination he took a position at Frome-Selwood, and in 1666 moved to Bath where

⁶² The biographical account is based on the excellent first chapter of Jackson I. Cope's *Joseph Glanvill Anglican Apologist* (St. Louis, 1956).

⁶³ Joseph Glanvill, *The Vanity of Dogmatizing*, Reproduction from 1661 edition for Facsimile Text Society, (New York, 1931). See Cope, p. 4, fn. 12 for an account of the particulars in which Glanvill's book is indebted to Wilkins' early publications.

he remained until his death. His contributions to scientific investigation are few: a paper on the lead mines at Mendip, a paper on the water at Bath, both of which were printed in the *Philosophical Transactions*,⁶⁴ and his investigations of alleged instances of witches which appear throughout his writings.

Intellectually he was at the forefront of the new scientific movement. He numbered among his acquaintances such notables as Sprat, Boyle, and Hooke. He was an apologist for the new science, his *Scepsis Scientifica*⁶⁵ (a revised version of the *Vanity of Dogmatizing*) of 1664 containing as its preface a eulogistic essay, "An Address to the Royal Society," which won him election as a fellow the same year. Four years later he published an extension to Sprat's *History of the Royal Society* entitled, *Plus Ultra: or, the Progress and Advancement of Knowledge Since the Days of Aristotle*.⁶⁶

Though he was a novice so far as discoveries or advances in the particular sciences are concerned, Glanvill's writings, particularly his *Vanity of Dogmatizing* and several of his essays, show considerable reflection on the theoretical aspects of scientific investigation, especially the problem of certainty. In the writers previously considered – Chillingworth, Tillotson, and Wilkins – the question of certainty was approached primarily in the context of religious problems: the Rule of Faith controversy, an attack on atheism, and the founding of natural religion. Because analogous problems arise about scientific knowledge, only that aspect of Glanvill's thought which shows the relevance of the principles so far developed to the theory of science will be emphasized. This limitation does injustice to Glanvill in that the whole of his views on religion are not treated extensively; the justification for this is the interest in showing that his approach to the question of certainty in science was similar to the approach already developed in theology. A comprehensive account of his religious philosophy would be too extensive.

Glanvill's views on the certainty of knowledge can best be appreciated by viewing them in the context of his first work, the *Vanity of Dogmatizing*, and of his last major one, *Essays on Several Important*

⁶⁴ *The Philosophical Transactions of the Royal Society of London, from their Commencement in 1665, to the Year 1800; Abridged, with Notes and Biographic Illustrations*, ed. by Charles Hutton et. al., 18 vols. (London, 1809). The reports on the Mendip mines occur in II (1667), 525-527 and III (1668), 767-771; the report on the water at Bath is in IV (1669), 977-983.

⁶⁵ Joseph Glanvill, *Scepsis Scientifica: or, Confest Ignorance, the Way to Science; In an Essay of the Vanity of Dogmatizing, and Confident Opinion* (London, 1665).

⁶⁶ Joseph Glanvill, *Plus Ultra: or, the Progress and Advancement of Knowledge Since the Days of Aristotle*, facsimile reproduction with introd. by Jackson I. Cope, (Gainesville, Fla., 1958).

Subject in Philosophy and Religion.⁶⁷ His lifelong interest as expressed in these, and as admirably shown by Cope, was to present an apology for Anglican theology.⁶⁸ The dogmatism of the Aristotelians in science and of the atheists in their denial of religious truth, and the excesses of superstitious religious enthusiasts are challenged as having no rational justification and as being destructive of religious belief. With respect to understanding nature his purpose is to improve science by attacking what he regards as its greatest enemy, unwarranted belief in what cannot be proved true. "*I have no design against Science: My indeavour is to promote it. Confidence in uncertainties is the greatest enemy to what is certain.*"⁶⁹ Since in his view absolute certainty cannot be attained because of the limitations of man's faculties and the complexity of nature, he makes it his general purpose to show that many things believed to be absolutely certain are not, and that any such claim is unwarranted dogmatism. A true appreciation of the limits of knowledge would lead to a better understanding of nature and to belief in God. He proceeds first to show the unreasonableness of dogmatism by exhibiting the wide extent of human ignorance; second, to analyze the causes of this condition; and, finally, to present his own views on knowledge and certainty. Let us consider each in turn.

Glanvill characterizes the limitations of man's faculties and the meagerness of his knowledge by a comparison with what man's estate probably was before the Fall of Adam. Man's faculties were then so perfect, using a mechanical metaphor, that he could "observe the first Springs and Wheels that set the rest [of the world] in motion,"⁷⁰ i. e., he could know the reality of things by directly observing their first and real mechanical causes. In that condition man had a perfect knowledge of nature, for science in its true sense "is the knowledge of things in their *true, immediate, necessary* causes."⁷¹ Such knowledge of causes, as Glanvill conjectures Adam's to have been, would be immediate since for Adam causality was a sensible relation. Further, in knowing

⁶⁷ Joseph Glanvill, *Essays on Several Important Subjects in Philosophy and Religion* (London, 1676) – hereafter cited as *Essays*.

⁶⁸ Cope, *op. cit.*, Chapter II and *passim*. In *The Seventeenth Century Background* (London, 1954), Basil Willey characterizes Glanvill as a transitional figure, linking the ages of Thomas Browne and Robert Boyle, and says that he "was in fact a typical 'modern churchman' of the Restoration period, a Fellow of the Royal Society, interested in every up-to-date theory and discovery, an ardent upholder of 'modern' versus 'ancient,' and especially concerned, as befitted his profession, to demonstrate 'the agreement of reason and faith,' and to explain how religious the 'science' of the Royal Society really was" (p. 170).

⁶⁹ *Vanity of Dogmatizing*, p. A3.

⁷⁰ "Against Confidence in Philosophy, And Matters of Speculation," *Essays*, p. 2.

⁷¹ *Vanity of Dogmatizing*, p. 189.

one causal connection all would be known since all events are linked together by an uninterrupted chain of causes. Unfortunately this has not been, as Glanvill sees it, the lot of man since the Fall of Adam. Ignorance and error abound. For orderliness' sake he classifies these false beliefs into two groups, those having to do with the soul and its relation to the body, and those which concern matter or body in general:

In things *without* us, our *shallowness* and *ignorance* need not be matter of much wonder, since we cannot pry into the hidden things of Nature, nor observe the first Springs and Wheels that set the rest in motion. We see but little parcels of the Works of God, and want *Phenomena* to make entire and secure *Hypotheses*: But if *that* whereby we know *other* things, know not *it self*, If our *Souls* are strangers to things *within them*, which they have *more* advantage to understand than they have in matters of *external Nature*; I think then, that this *first* will be a *considerable Instance* of the *scantness* and *imperfection* of our *knowledge*.⁷²

With respect to mind Glanvill claims to show the extent of ignorance and the vanity of dogmatizing by pointing out that there are many as yet unsolved problems,⁷³ some metaphysical and some psychological. For example, there is no universal agreement concerning either the origin or nature of the mind, or of its union with the body. There is no acceptable account of how the soul affects the body, how memory works, or of how motion in a sense organ produces an image in the mind. Problematic aspects of the views of Aristotle, Descartes, More, and Kenelm Digby (1603–1665) on these subjects are cited as evidence for their being unresolved. Similarly, there is no satisfactory account of how the human body is formed. Concerning matter in general, objections can be raised against any account of its composition, of the adherence of its parts to one another, and of its divisibility. In presenting this account of human ignorance Glanvill, it should be noted, is not employing the Cartesian method of systematic doubt, but only pointing out that most claims to knowledge are dogmatic presumptions. He does not, as Descartes' method would demand, deny the existence of mind, memory, and matter, but only denies that any claims to knowledge about them are justified. The existence of mind, body, sensation, memory, and so on, he takes as unquestioned. The fact that there are so many instances of error and ignorance makes any claim of understanding the world pretentious dogmatism.

Another phase of his attack on dogmatism – which is aimed at

⁷² "Against Confidence in Philosophy," *Essays*, pp. 1–2.

⁷³ In "Of Scepticism and Certainty: In a short Reply To the Learned Mr. Thomas White" (*Essays*, p. 51), he points out to White that the problems stated in the earlier book were not to be taken as insoluble but only as presently unsolved.

showing the folly of adherence to an outdated but persistent philosophical system – is a scathing critique of Aristotelianism. Glanvill claims first it is merely verbal, “an huddle of *words* and *terms insignificant* ... To wrest names from their known meaning to Senses most alien, and to darken *speech by words without knowledge*; are none of the most inconsiderable faults of this *Philosophy*.”⁷⁴ Secondly, it gives rise to unending disputes, as the history of thought reveals to even the casual observer. Being interested in dispute Aristotelians are unac-

⁷⁴ *Vanity of Dogmatizing*, pp. 150–151. The attack is an extended one, covering some forty pages of the text, pp. 148–188. Such criticism of Aristotle was by no means a unique undertaking in seventeenth century England and was one Glanvill shared with many others, including Samuel Parker (1640–1688), a student of Wilkins and Bishop of Oxford. Like Glanvill, Parker was an advocate of the method of the Royal Society and criticized Aristotelianism as verbal and empty of results. In his *A Free and Impartial Censure Of the Platonick Philosophie, Being a Letter Written to his much Honoured Friend Mr. N. B.* (Oxford, 1666), he writes: “The chief reason, therefore, why I prefer the Mechanical and Experimental Philosophie before the *Aristotelian*, is not so much because of its so much greater certainty, but because it puts inquisitive men into a method to attain it, whereas the other serves only to obstruct their industry by amusing them with empty and insignificant Notions. And therefore we may rationally expect a greater Improvement of Natural Philosophie from the *Royal Society*, (if they pursue their design) then it has had in all former ages; for they have discarded all particular *Hypotheses* and wholly addicted themselves to exact Experiments and Observations ...” (p. 45). He adds that in his estimation even the Royal Society will be unable to achieve perfect scientific knowledge, the purpose of which is “to search into and discover the Nature of things” (p. 69), for “whether it be possible to frame any certain Hypotheses or no, which is the thing I most doubt of, because, though the *Experiments* be exact and certain, yet their Application to any *Hypothesis* is doubtful and uncertain; so that though the Hypothesis may be a firm *Basis* to bottom upon, yet it can be fastned and cemented to it no other way, but by conjecture and uncertaine (though probable) applications, and therefore I doubt not but we must at last rest satisfied with true and exact Histories of Nature for use and practice; and with the handsomest and most probable *Hypotheses* for delight and Ornament” (pp. 45–46). The best explanations (hypotheses) are only for use and ornament, echoing the claim of Wilkins and Glanvill that scientific knowledge is not of the reality of things nor admits of absolute certainty. He points out further that since the mind itself is inherently liable to deceit, scientific explanation is never of the reality of things which are too complex to understand: “Ther’s nothing can more perplex my Faculties, than the simple *Idea* of Naked matter. And certainly, it was never intended that meer Essences should be the objects of our Faculties. And therefore the truly wise and discerning Philosophers ... only search after the Properties, Qualities, Vertues and operations of Natural Beings; the Knowledge whereof may be acquired by Observations and Experiments; but there are no certain means or rational Methods ... to investigate the mysterious Ideas of bare and abstracted Essences” (p. 64).

Another feature of Parker’s views which parallels the accounts Wilkins and Glanvill give of knowledge is the thesis that knowledge comes from sense experience. But Parker goes a step further than either Wilkins or Glanvill in claiming, in a critique of innate ideas, that even the most general principles are empirically founded. Such a principle as that the whole is greater than any of its parts is for Parker an empirical principle, and is as certain as anyone could demand. He points out that even if general principles were innate one would have no guarantee of their truth since the faculties by which they are apprehended might be deceived (p. 56). The only test for such principles is experience, “because Experimental knowledge is of all others the safest and most unquestionable, and therefore must needs render all lesser evidence vain and unnecessary. At least when our knowledge proceeds in an Empirical way ‘tis solid and palpable, and made so undoubtedly certain from the plain and most undoubted Testimony of Sense and Experience, and undeniably to convince Scepticism of a pitiful and ridiculous Obstnacy” (p. 57).

quainted with the practical and experimental aspects of scientific investigation. In its explanation of observed phenomena this philosophy is valueless because it attempts nothing concerning those phenomena that are remote in space and time, and is unsatisfactory concerning those near at hand: "Even the most common productions are here resolv'd into *Celestial influences, Elemental combinations, active and passive principles, and such generalities*; while the particular manner of them is as hidden as *sympathies*. And if we follow *manifest qualities* beyond the empty signification of their Names; we shall find them as *occult*, as those which are professedly *so*." ⁷⁵ This form of dogmatism also leads to skepticism, says Glanvill, because its explanations in terms of occult principles leave the real nature of the world "intellectually invisible."

In the next place the Aristotelian philosophy has contributed nothing useful to mankind – no inventions or discoveries can be laid to its credit. Since for Glanvill, as for Bacon, one test of a philosophy is its practical accomplishments for the improvement of human life, the philosophy of Aristotle is to be rejected as useless. Finally, since it is inconsistent with Christianity in that it denies the possibility of the resurrection and affirms the eternity of the world, it must be rejected as irreligious. Aristotelianism, then, is to be rejected as verbal, empty of significant results, as giving rise to a serious skepticism about the nature of reality, and as irreligious.

In the final phase of his objections against dogmatism Glanvill attempts to show the impossibility of the science of nature the dogmatist claims to have, "the knowledge of things in their *true, immediate, necessary* causes." Only theology and mathematics are exempted from this attack for they are not, as we shall see, about the natural world. His aim is to point out that a complete understanding of nature is not possible since the real causal connections among natural events are not discoverable. He first establishes that knowledge of causality is not gained by sense perception, and that demonstration of matters of fact (and thus *a fortiori* of the causal relation) is impossible, and then, since a knowledge of nature in the dogmatist's sense involves an understanding of "the first Springs and Wheels" of an event and of all events causally related to it, that the knowledge required to construct dogmatic science is not possible.

Glanvill begins his discussion of causality by stating that in man's present situation causality is not known by sense experience "for the

⁷⁵ *Vanity of Dogmatizing*, pp. 170-171.

causality is it self *insensible*.”⁷⁶ No evidence is given here for this claim, but elsewhere he shows the weakness and liability to deception of the senses, pointing out that only the gross and external aspects of nature are observable. Sequences can be observed, but “to argue from a concomitancy to a causality, is not infallibly conclusive.”⁷⁷ To conclude from the constant conjunction of heat and flame that the former is caused by the latter may be to commit the the fallacy of *post hoc, ergo propter hoc*, for “how know we the contrary, but, that something, which always attends the grosser flame, may be the cause of *heat*?”⁷⁸ The flame may be a mere “uninfluential attendant,” or itself and heat both the effects of some other cause.

There are further difficulties concerning immediate sensibility of the causal relation in the way of the dogmatic scientist. First, there is the question of the resemblance of cause and effect.⁷⁹ On the level of daily experience there is no resemblance: an egg, using Glanvill’s examples, is not like the hen into which it grows, mud not like the insects which arise from it, nor a seed like the plant into which it matures. Since on this level there is no resemblance, it is quite likely that the same is the case in the inner recesses of nature, making it virtually impossible for anyone to infer a real cause from what is observed. One may suggest probable causes, “but infallibly to determine, *how they truly were affected*, is proper to him only that saw them in the *Chaos*.”⁸⁰ Again, events are so bound together that to understand a single causal relation one must understand all; hence to have science in the dogmatist’s sense, one would have to understand everything to understand any one event. “Thus then, to the *knowledge* of the most contemptible effect in nature, ‘tis necessary to know the whole *Syntax* of Causes, and their particular *circumstances*, and *modes* of action.”⁸¹ This being a task far exceeding the capacities of the senses, Glanvill concludes that dogmatic science has failed in one aspect of its program, to establish an immediate knowledge of causes. Since the senses fail to discern causal relations, the high degree of certainty attending immediate sensory knowledge cannot occur in science.

⁷⁶ *Ibid.*, p. 190. For an extended account of Glanvill’s views on causality see Richard H. Popkin, “Joseph Glanvill: Precursor of Hume,” *The Journal of the History of Ideas*, XIV (1953), 292–303. For an account of the relation of his theory of science to Francis Bacon’s, see Dorothea Krook, “Two Baconians: Robert Boyle and Joseph Glanvill,” *The Huntington Library Quarterly*, XVIII (1955), 261–278.

⁷⁷ *Vanity of Dogmatizing*, p. 190; see also “Against Confidence in Philosophy,” *Essays*, p. 15.

⁷⁸ *Vanity of Dogmatizing*, p. 190.

⁷⁹ *Ibid.*, p. 210; see also “Against Confidence in Philosophy,” *Essays*, pp. 15–16.

⁸⁰ *Vanity of Dogmatizing*, p. 212.

⁸¹ *Ibid.*, pp. 217–218.

As dogmatic science fails to attain an immediate knowledge of causal relations, so also it cannot attain a necessary knowledge of them. This Glanvill substantiates by showing that demonstrations concerning natural events are not possible. He intends to show that the very high degree of certainty which attends demonstration cannot be attained of the conclusions of science, thus dispensing with the dogmatist's claim to have absolute certainty. By a necessary or demonstrative conclusion Glanvill means one "where the contrary is *impossible*" and which "cannot be otherwise;" it is one the negation of which is self-contradictory. Such conclusions concerning nature are not within our grasp for two reasons: first, the weakness of the rational faculties makes man liable to error, and second, demonstrations are based upon "Principles of our own, not [of] universal Nature."⁸² The belief that the negation of a given demonstration is self-contradictory is a human belief which, being dependent upon fallible reason and imagination, may be mistaken. What may seem inconceivable to man may not really be so. Consequently the belief that a given statement has been demonstrated may rest upon a confusion of psychological inconceivability with logical or physical impossibility. None of the conclusions regarded as necessary need actually be so for "are not many things certain by the *Principles* of one, which are impossible to the apprehensions of another?"⁸³ What is true in Platonic philosophy may be false in the Aristotelian, Cartesian, or some other philosophy. What is demonstrated on one set of principles may be false on another, implying that no one set of philosophic principles is necessarily true. Even if everyone in the world were agreed on a particular set of principles, "'tis not unlikely, but what's impossible to all *Humanity* may be possible in the *Metaphysicks* and *Physiologie* of Angels."⁸⁴ Thus the requirement of dogmatic science that there be necessary as well as immediate knowledge of causes has been shown impossible of fulfillment. Glanvill here parallels a similar conclusion of such men as Chillingworth and Wilkins about religion, that demonstrative knowledge (and hence absolute certainty) about matters of fact is beyond man's capacity. As they had insisted about religious knowledge that it is only

⁸² *Ibid.*

⁸³ *Ibid.*, p. 194.

⁸⁴ *Ibid.*, p. 195; see also "Against Confidence in Philosophy," *Essays*, p. 15. In this connection Popkin notes, in the article cited above, a circularity in Glanvill's argument. Since the dogmatist claims his principles are necessarily true, Glanvill's refutation must consist in showing that they are only hypothetical. Glanvill's reply, however, is that because any set of man-made principles is hypothetical, any deductions from them are at best only probable, thus assuming the point at issue.

morally certain, so he concludes (as we shall discuss in more detail later) that scientific knowledge is only indubitably certain.

As Glanvill is systematic in his criticism of dogmatism so is he in his exposition of the causes of human ignorance and pretensions to knowledge. The primary reason for man's inability to know "the first Springs and Wheels that set the rest in motion" is the theological one of the fall of man from that original state of blessedness in which the inner workings of nature were directly open to sense experience. But in addition to this a more particular account can be given. In the first place, nature is complex, making genuine knowledge difficult to attain: "They are only Natures grosser wayes of working, which are sensible; Her finer threads are out of the reach of our feeble *Percipient.*"⁸⁵ Also, since events are linked in causal chains one cannot know one link without knowing many others, thus making the task extremely difficult. On this side of death man can see truth only in a rare glimpse for it is everywhere bound up with opinion and the two can only with difficulty be separated.

Second, there is the fallibility and weakness of the senses which give reports on only a restricted range of objects and then only of their appearances. Since the sciences are built on such reports – "we cannot conceive any thing, which comes not within the verge of our senses"⁸⁶ – they invariably miss the real nature of things. Though the senses provide their own corrective in some instances, in many deceit is undetected. Since the errors of the senses have "so mingled themselves with our Genuine Truths, and being as plausible to appearances as they; we cannot gain a true assurance of any [of their reports], but by suspending our assent from all, till the deserts of each, discover'd by a strict enquiry, claim it."⁸⁷ And, laments Glanvill, it is difficult to remove a defect so close to man's soul. An additional problem is the absence of a guarantee that the perceptions one person has in any way resemble those of anyone else.⁸⁸ The passions also

⁸⁵ *Vanity of Dogmatizing*, pp. 67–68. Ferris Greenslet, in his *Joseph Glanvill: A Study in English Thought and Letters of the Seventeenth Century* (New York, 1900), pp. 95–111, points out that Glanvill's account of the causes of human ignorance is derived in large measure from Sextus Empiricus. Glanvill may have had direct access to a copy of Sextus' writings, or may have used Thomas Stanley's *The History of Philosophy* (London, 1655), which contains large extracts from the skeptic's writings.

⁸⁶ *Vanity of Dogmatizing*, p. 25; see also pp. 67–76 and 218–222.

⁸⁷ *Ibid.*, p. 73; see also "Against Confidence in Philosophy," *Essays*, pp. 17–18. The cases of the bent oar and round tower are cited; by taking the oar out of the water or approaching the tower the senses give notice of their earlier mistake.

⁸⁸ *Vanity of Dogmatizing*, pp. 218–219; see also "Against Confidence in Philosophy," *Essays*, pp. 19–20. Wilkins in *Natural Religion* (p. 57) had denied that this was so.

affect the senses, giving rise to beliefs which are not true; for example, one is inclined by the passions to believe that heat is a quality of fire, rather than of oneself. Strictly speaking, Glanvill insists, it is not the senses themselves which are deceptive, but one's "precipitate judgments," one's coming to unwarranted conclusions on the basis of information accurately presented by the senses.

It is interesting to note in connection with our earlier remarks concerning the role of Bacon's thought in the seventeenth century that Glanvill accepts a modified Baconian view concerning the errors of sense perception. Bacon had stated that all knowledge about nature depends upon the senses, but, recognizing that they are inherently weak, proposed that they be fortified with mechanical aids to assure the truth of such knowledge as is based on them. Glanvill accepts these three theses, though he modifies the last. In his "Of the Modern Improvements of Useful Knowledge," a slightly modified essay version of his *Plus Ultra*, he writes about the need for mechanical aids: "... our *Senses* must be *aided*; for of themselves they are too narrow for the *vastness* of things, and too *short* for *deep Researches*: They make us very *defective* and *unaccurate Reports*, and many times very *deceitful* and *fallacious ones*: I Say therefore, *they* must be assisted with *Instruments*, that may *strengthen* and *rectifie* their *Operations*." ⁸⁹ In a preceding

⁸⁹ "Of the Modern Improvements of Useful Knowledge," *Essays*, p. 23; see also *Plus Ultra*, pp. 52-53. Another member of the Royal Society particularly interested in the relation between the natural faculties and mechanical instruments was Robert Hooke, whose work with the microscope earned him a just title to fame. In the preface to his *Micrographia*, which he wrote because of Wilkins' influence, Hooke begins by pointing out "the mischiefs, and imperfections, mankind has drawn upon itself, by negligence and intemperance, and a willful and superstitious deserting the Prescripts and Rules of Nature, whereby every man, both from a deriv'd corruption, innate and born with him, and from his breeding and commerce with man, is very subject to slip into all sorts of errors" (p. 1). These defects affect the senses and memory, and through them the understanding. Depending upon the temperament of the person involved, these defects give rise "to gross ignorance and stupidity, and ... to *presumptuous imposing* on other Mens Opinions, and a confident dogmatizing on matters, whereof there is no assurance to be given" (p. 2).

The general solution Hooke proposes is the development of the experimental or mechanical philosophy. More specifically, he follows in the Baconian tradition of proposing mechanical aids to alleviate the imperfections of memory and understanding. In the case of sense perception, from which he claims all knowledge arises, he is particularly interested in the microscope and telescope as aids to vision, and suggests that analogous instruments be developed for the other senses (Preface, pp. 1, 4, 8, and also "Experiments and Observations for the improvement of the barometer," in Gunther, *Early Science in Oxford*, VII, 685). Hooke is astute enough to recognize, however, that an appeal to such mechanical aids is no adequate cure for the defects which are innate, particularly those of the senses. In an essay, "An Attempt to Prove the Notion of the Earth from Observations ..." (reprinted in Gunther, VIII), in which he tries to present an *experimentum crucis* to decide between the Tychonean and Copernican theories, he points out difficulties which, if generalized, would affect any attempt to discover the complete truth by the use of mechanical instruments. The difficulties are: 1) the instruments may contract or expand with careless exposure to weather conditions, 2) the weight, or other structural features, of the instrument may affect readings, and 3) the

essay, however, though recognizing the utility of such instruments as the microscope, telescope, thermometer, and so on, he questions their validity on the ground that nature is too complex for even the senses fortified with the most accurate instruments. He writes:

There is *Prodigious fineness* and *subtilty* in the *works of Nature*, which are too *thin* for our *Senses*, with all the advantages Art can lend them: And many, the greatest, and the best of its Objects are so *remote* that our Senses reach them not by any *Natural* or *Artificial* helps: So that we cannot have *other* than *short* and *confused* apprehensions of those works of Nature: And I sometimes fear, that we scarce yet see any thing as it is.⁹⁰

As a consequence, Glanvill precludes from science the absolute certainty which Bacon believed would be forthcoming from application of his method to the ways of nature.

Next, the imagination and the understanding itself obstruct the acquisition of scientific knowledge. The imagination, if it misapprehends or unjustifiably compounds or divides images, presents the mind with an occasion to misjudge. Reason too, as affected by early training and custom, is inclined to make judgments before all evidence has been considered, thus "contracting many times a firm and obstinate belief from weak inducements; and that not only in such things, as immediately concern the sense, but in almost everything that falls within the scope of our enquiry."⁹¹ Lastly, the feelings are so affected by training, education, and custom, that one is inclined to accept as true what is pleasing and regard as false what is displeasing, even when one has considered the evidence. The faculties, then, insofar as they are misled or are precipitate in judgment or are inherently defective, lead away from that necessary knowledge of causes, which is science.

From the severity of his censure of dogmatic science and his open and unveiled insistence upon the difficulty of attaining knowledge about nature – because of the obscurity of the inner workings of nature and the weakness and fallibility of the senses and intellect – it should not be inferred that Glanvill was a complete skeptic. In an essay, "Of Scepticism and Certainty," written in reply to a criticism by Thomas White⁹² of his *Vanity of Dogmatizing*, Glanvill denies the charge that he

calibrations of the scales and dials may be inaccurate, all of which may affect the results (pp. 8–9). Even if such problems as these can be corrected, Hooke thinks it still presumptuous to claim that absolute truth about nature can be gotten, for future observations may reveal new information, and every account of nature depends on assumptions which may be false.

⁹⁰ "Against Confidence in Philosophy," *Essays*, p. 17.

⁹¹ *Vanity of Dogmatizing*, pp. 106–107.

⁹² Thomas White, *Scire sive Sceptices et Scepticorum a jure Disputationis Exclusio*, (London, 1663). In 1665 there appeared *An Exclusion of Scepticks from all Title to Dispute*, printed at London, an English version of the earlier work.

is one of those extreme skeptics who suspend judgment on everything and regard no one thing as any more probable than another. Since it is natural for man to confide in his opinions, says Glanvill, it is unlikely that there is anyone who is a skeptic of the extreme sort. The alternative to skepticism is not dogmatism, but diffidence – a reservation in judgment until all evidence has been considered. Having disclaimed skepticism in the destructive sense, it does not follow that Glanvill is not himself a skeptic. There are two senses in which he can be so classified: the first is the sense in which he thinks the Royal Society is skeptical, namely in reservation of judgment until all evidence has been considered – a cautious prudence in giving assent; the second and more serious sense is his view that the inner structure of nature really cannot be known and thus that scientific knowledge at best is only probably true. These two features together make up constructive as opposed to destructive skepticism.

In an essay, "To the Learned Tho. Albius," he explains to the Aristotelian Thomas White his motive for the "personated scepticism" of the *Vanity of Dogmatizing* and where the difference between them in the pursuit of science lies:

... our ends [are] so far from being repugnant, that they are coincident; only we differ in the Means, and Method. The End of both is the Advance of Knowledge, which you think is best promoted by pressing a persuasion, that Science is not uncertainty. And I suppose that the quarrelsome World needs to be convinc't, That Uncertainties are not Science. Now the progress of Knowledge being retarded by extream Confidence on the one hand, and Diffidence on the other; I think that both are necessary, though possibly one's more seasonable. For to believe that everything is certain, is as great a disinterest to Science, as to conceive that nothing is so.⁹³

Just as the belief that knowledge about the world is absolutely certain is detrimental to the advance of science as he found it practiced by the Royal Society (after his disenchantment with Descartes), so too is that other extreme of the Pyrrhonian skeptic who suspends judgment concerning all things. In the *Vanity of Dogmatizing* he had been trying to show that "uncertainties are not science," that is, that the claims of the Aristotelians and other dogmatists to understand nature are unwarranted assertions, not scientific statements. In addition to this negative thesis Glanvill has a positive one, that science is certainty, by which is meant a provisional assent, an assent meted out in accordance with the available evidence.

⁹³ This essay is a preface to Glanvill's *Scire/i tuum nihil est: or, The Author's Defence of the Vanity of Dogmatizing; Against the Exceptions of the Learned Tho. Albius In his Late Sciri* (London, 1665), which is bound with *Scepsis Scientifica*. See also in this connection "Of Scepticism and Certainty," *Essays*, p. 45.

Having recently joined the Royal Society, as an ally against White and the "philosophy of the Schools,"⁹⁴ Glanvill presents its method as having this feature of a provisional assent to cautiously established conclusions: "the *Free Philosophers* ... continue ... to seek Truth in the Great Book of Nature; and in that search to proceed with wariness and circumspection without too much forwardness in establishing Maxims, and positive Doctrines: To propose their Opinions as *Hypotheses*, that *may probably* be the true accounts, without peremptorily affirming that *they are*."⁹⁵

The ultimate aim of scientific inquiry, it should be noted, is the same for Glanvill as for the dogmatist, the knowledge of the first and real causes of things, the "Springs and Wheels that set the rest in Motion." Since for the reasons already presented such knowledge is presently beyond man's capacities, the aim of the scientist must be set lower: to discover hypotheses to explain observed phenomena and to discover in nature what is of value for the improvement of human life. From the standpoint of theology, which was his major concern, Glanvill thinks science, as pursued by the Royal Society, will be a corrective for atheism and enthusiasm. By discovering order and organization and beauty in the world a strong argument for God's existence becomes possible. The attitudes of caution and reservation in making judgments and the willingness to revise conclusions are the antidote to enthusiasm, which is characterized as an irrational and emotional approach to religious doctrines.

The only exceptions to his account of knowledge are mathematics and theology. Mathematics is "built upon clear and settled *significations* of names, which admit of no *ambiguity* or insignificant *obscurity*,"⁹⁶ and is neither about the world nor a product of sense experience. The truths of Christianity, on the other hand, have been unchanged since their revelation some 1600 years earlier and can be known by any person of ordinary intelligence.⁹⁷ In admitting these exceptions Glanvill is, however, yielding nothing to the dogmatist, for theological truths are not in dispute, being no part of science, and mathematical truths are merely products of man's own mind and thus reveal nothing of the world created by God.

The key to the establishment of such scientific truth as is possible is to proportion assent to evidence: "*if a man measures out the degrees of his*

⁹⁴ Cope, pp. 121-122.

⁹⁵ "Of Scepticism and Certainty," *Essays*, p. 44.

⁹⁶ *Vanity of Dogmatizing*, p. 160.

⁹⁷ *Ibid.*, pp. 186-187.

assent to Opinions, according to the degrees of Evidence, being more sparing and reserved to the more difficult, and not thoroughly examin'd Theories, and assured only of those that are clearly apprehended, and have been fully thought of, He stands upon a firm Basis, and his Science is not moved by the gusts of phancy and humour, which blow up and down the multifarious Opinionists." ⁹⁸ Here is a theme which again ties Glanvill directly to the tradition of which Chillingworth, Tillotson, and Wilkins are a part. Their espousal of the theme of the proportionality of assent to evidence occurred with respect to theological issues; Glanvill's, in this aspect of his writing at least, with respect to understanding nature. Just as they were attempting to prove against dogmatic Catholic apologists the emptiness of ungrounded belief and argue for belief based upon a careful consideration of available evidence, so he is attempting to expose the emptiness of dogmatic science in order to establish science upon a more reasonable basis. What he says about certainty is not new, but he is making more explicit a theory about certainty which before had been limited primarily to religious belief.

This coincidence of outlook between Glanvill and his contemporaries extends also to their views on the kinds of certainty one can have of both scientific and religious truth. In the essay, "Of Scepticism and Certainty," which he dedicates to an unnamed friend – it may have been Wilkins – he distinguishes, using terminology which also appears in both Tillotson and Wilkins, indubitable from infallible certainty. The former he defines as a firm assent to anything for which there is no reason to doubt, the latter as the absolute assurance that things are as they are understood and cannot possibly be otherwise.⁹⁹ This second kind of certainty is not humanly attainable for it is always possible that man's faculties may be deceived about what is judged to be most certain and assured.¹⁰⁰ Admitting this, Glanvill is acknowledging an ultimate

⁹⁸ "To the Learned Thomas Albius," a prefatory letter to *Scire/i tuum nihil est*; see also *Scire/i tuum nihil est*, p. 52, and "Of Scepticism and Certainty," *Essays*, p. 46.

⁹⁹ "Of Scepticism and Certainty," *Essays*, pp. 46–47.

¹⁰⁰ *Ibid.*, p. 50. Note that this assumption is also made by Tillotson (*Works A*, p. vi) and More. In his *Antidote Against Atheism* More writes, "For it is possible that Mathematical evidence it self, may be but a constant undiscoverable delusion, which our nature is necessarily and perpetually obnoxious unto, and that either fatelly or fortuitously there has been in the world time out of minde such a Being as we call Man, whose essentiall property is most of all to be mistaken, when he conceives a thing most evidently" (p. 3). Since, according to More, the conditions for error can be stated and the possibility exists that mankind is universally deceived even in mathematics where demonstration seems most likely, it follows that deceit can occur in the other areas of knowledge where at best there is only proof, i.e., arguments which are convincing but are not demonstrations. The way out of the difficulty chosen by More is to postulate the veracity of the faculties. See fn. 45 above.

skepticism which, so far as human nature is concerned, cannot be overcome. It belongs only to God to have such certainty as this.

The evidence which warrants indubitable certainty arises from the mind itself, from the senses, and from testimony. Depending upon the excellence of the evidence the degree of certainty is greater or less, but among the three none has a privileged status since each can only give rise to that degree of certainty called indubitable.

The greatest certainty attainable is based on evidence from the mind and is of principles implanted there by God which are recognized as true as soon as their meanings are understood. As examples of principles so known Glanvill cites Descartes' dictum, I think, therefore I am, and such other principles as: we can reason, everything is or is not, a thing cannot both be and not be in the same respects, nothing has no attributes, and what we conceive to belong or not to belong to anything we can affirm or deny of it.¹⁰¹ These last principles are necessary for all reasoning, though not everyone is consciously aware of them. Also in this classification is mathematics which, though its exact status is somewhat obscure, has "uncontroverted certainty." Since the capacity to make deductions is inborn, deductions from such principles alone or from them in conjunction with information of the senses also yield indubitable certainty of the highest kind, providing, of course, that this faculty is not perverted.

In connection with the role the faculties play in comprehending truth there is another principle of which one can be indubitably certain but which cannot be proved, namely, that the faculties do not always deceive. His point is that in spite of the objections which can ultimately be raised against any claim to knowledge, men do know some things and those with certainty of a limited sort. So far as there is evidence one is entitled to belief. To this end the Anglican apologist makes it an article of faith – which belief is itself a rational act – that the faculties do not deceive:

The belief of our Reason is an Exercise of Faith; and Faith is an Act of Reason. The former part is clear ... and we believe our Reasons, because we have them from God, who cannot mistake, and will not deceive. So that relying on them, in things clearly perceived, is trust in God's veracity and goodness, and that is an exercise of Faith ... And for the other part, that Faith is an Act of Reason, that is evident also: For 'Tis the highest Reason to believe in God revealing.¹⁰²

There are two justifications for this article of faith. The first, which he shares with Tillotson, is that God is a God of goodness and truth and

¹⁰¹ "Of Scepticism and Certainty," *Essays*, pp. 47-48.

¹⁰² "The Agreement of Reason and Religion," *Essays*, p. 21.

therefore would not let man be deceived when he perceives something clearly.¹⁰³ The second, which he develops – as Hume was also to do later – against the extreme skepticism of Descartes' *Meditations*, is that unless such a principle is accepted there can be no reasoning at all and hence no knowledge.¹⁰⁴

This indubitable certainty can arise also from the evidence of sense, though Glanvill admits the theory here is not too clear. There are certain conditions which must be fulfilled before the reports of the senses can be accepted – conditions of medium, distance, and so on. "But when the Senses are exercised about their right Objects, and have the other Circumstances that are requisite, we then assent without doubting."¹⁰⁵ This certainty is not the highest possible since it is always possible that things are not as the senses portray them, but, having made the assumption that the faculties do not always delude, the possibility alone does not affect the activity of the scientist. When the above mentioned conditions – which are essentially those of Aristotle's *De Anima*¹⁰⁶ – are fulfilled one can be as certain of the reports of sense as of the principles of reason. To the extent that they are not fulfilled the certainty is less.

Testimony too, when it is "general, both as to time and place uninterested, full, plain, and constant, in matters of Sense and of easie Knowledge,"¹⁰⁷ can give rise to indubitable certainty. Making the assumption that "*Mankind cannot be supposed to combine to deceive, in things, wherein they can have no design or interest to do it,*"¹⁰⁸ one can be as certain as of a mathematical demonstration that, for example, there are such places as Constantinople and Rome, Greece and Italy. Here too the degree of certainty can vary, depending upon the number and honesty of the witnesses. The evidence of testimony plays a role in both religion and science. As a theologian Glanvill recognizes that it is only by the testimony of the writers of the Scriptures that one knows anything about the historical events of the life of Christ. In science testimony is equally important. One of the functions of the Royal Society, as Glanvill sees it, is to "collect experiments" and compile natural histories in the several areas of inquiry. If such records cannot be accepted as authentic and trustworthy all of science would become

¹⁰³ *Ibid.*, pp. 20–21.

¹⁰⁴ "Of Scepticism and Certainty," *Essays*, pp. 48–51.

¹⁰⁵ *Ibid.*, p. 49.

¹⁰⁶ Aristotle, *De Anima*, II, 5–12.

¹⁰⁷ "Of Scepticism and Certainty," *Essays*, p. 49.

¹⁰⁸ *Ibid.*

worthless, including his own efforts to prove the existence of witches.

In the presentation of his ideas we have so far viewed Glanvill as a theorist of the kind of science he thought the Royal Society was advocating. He was, in addition, a practitioner of the new science, not only in his descriptive accounts of the water at Bath and the Mendip lead mines, but primarily in his observations about witchcraft.¹⁰⁹ His motive for wanting to prove their existence, an interest he shared with More¹¹⁰ and Boyle,¹¹¹ was the practical one of defending Christianity against its detractors. In the views of the irreligious the doctrines of the reality of spirits and of angels, the resurrection of the body, and the immortality of the soul all hang together with the being of witches; consequently, a denial of their existence would undermine some of the basic doctrines of Christianity. By a witch Glanvill means someone who has made an unlawful agreement with an evil spirit which enables him to perform actions, not necessarily evil, beyond the natural powers of man, for example, the control by the power of imagination of a conversation in another room, or a rapping on a table in an unoccupied room.

In presenting his proof for their existence Glanvill claims that it "being matter of Fact, is only capable of the evidence of Authority [of testimony] and Sense: And by both these, the being of Witches and Diabolical Contracts, is most abundantly confirm'd."¹¹² The denial of existing empirical evidence would, he says, make romance of history which is full of authenticated accounts of witches, make murderers of judges who have prosecuted witches, and liars of witnesses who have testified concerning their behavior. Glanvill presents his case for the existence of witches in two ways: first by answering objections against the possibility of their existence, and then by presenting

¹⁰⁹ Glanvill's writings about witches began with *A Philosophical Endeavour towards the Defense of the Being of Witches and Apparitions* (London, 1666), later published with additions as *A Blow at Modern Sadducism* (London, 1667), and again, posthumously by More with some of More's own writings, as *Sadducismus Triumphatus: or, Full and plain Evidence Concerning Witches and Apparitions*, (London, 1681). The edition to which reference will be made here is the London edition of 1688 of *Sadducismus Triumphatus*. Another version, somewhat shortened and modified, of *A Blow at Modern Sadducism* appears as "Against Modern Sadducism In the Matter of Witches and Apparitions" in the *Essays*.

¹¹⁰ Henry More published the posthumous editions of Glanvill's *Sadducismus Triumphatus*; to the edition of 1688 he added some stories of his own to those Glanvill had already collected. See also More's *Antidote Against Atheism*, Book III, chapters 2-15 for more stories of witches and apparitions More accepts as true.

¹¹¹ Boyle and Glanvill corresponded concerning witchcraft, the latter requesting that Boyle contribute some information he had about witches in Ireland to a forthcoming publication (*The Works of the Honourable Robert Boyle*, VI, 59, 631-633).

¹¹² "Against Modern Sadducism In the Matter of Witches and Apparitions," *Essays*, pp. 2-3; see also *Sadducismus Triumphatus*, p. 67.

authenticated accounts of their reality. Of the objections he answers – that the being of witches is an impossibility, that the activities ascribed to them are non-natural, that the devil would not be at the beck and call of witches, that the existence of witches denies God's providence, and so on – the first is the most important. People who deny witches do not reject the evidence there is for them, but claim their existence is an impossibility. Glanvill replies that this is no more impossible than that of the soul or other spirits, and that it is as likely that the atmosphere is populated with rational beings as that there are minute non-rational ones inhabiting water. To claim that the existence of witches is an impossibility is, he says, to go contrary to correct procedure in authenticating matters of fact:

Matters of Fact well proved ought not to be denied, because we cannot conceive how they can be performed. Nor is it a reasonable method of Inference, first to presume the thing impossible, and thence to conclude that the Fact cannot be proved: On the contrary, we should judge of the Action by the Evidence, and not the Evidence by our Fancies about the Action. This is proudly to exalt our own Opinions above the clearest Testimonies, and most sensible Demonstrations of Fact: and so to give the Lye to all Mankind, rather than distrust the Conceits of our bold Imaginations.¹¹³

The point he is trying to get across is that questions of fact, whether it be of the existence of witches or some occurrence investigated by one of the particular sciences, cannot be demonstrated, but are rather to be settled by an appeal to evidence. The belief that their existence is impossible is really only a case of psychological inconceivability. It is not at all impossible that witches be sent through the air by the devil or transformed into strange shapes.

As the explanations given in science do not explain how an event occurs, so too the accounts given in witchcraft do not explain how such events occur. His evidence, says Glanvill, is aimed only at proving that witches exist. Further, says he, his only aim is to give a probable account in terms of the evidence. Having done this, those who claim that their existence is impossible must admit defeat, for if a probable account of their existence can be given on the basis of testimony and sense experience, no one can justifiably say they are impossible.¹¹⁴

Such then are the views of an early member of the Royal Society concerning certainty. The dogmatism of the Aristotelian scientists is to be eschewed since it is empty of results and pursues only a shadow of the truth. Its claim to certainty is unwarranted since the processes of

¹¹³ "Against Modern Sadducism in the Matter of Witches and Apparitions," *Essays*, pp. 7–9; see also *Sadducismus Triumphatus*, p. 73.

¹¹⁴ "Against Modern Sadducism In the Matter of Witches and Apparitions," *Essays*, p. 59.

nature are too obscure for human scrutiny and man's faculties too obtuse to perceive accurately. At best only a small part of nature is observable and this not its elemental nature, but only external appearances. Upon the basis of such appearances, arranged and combined in suitable fashion, conjectures can be made about their real mechanical causes. But since the source of such appearances is the faulty senses, and because the real mechanical causes of things exceed comprehension, any conclusions made about nature are hypothetical and as such only probably true. Here, in his theory of science, Glanvill proposes what has been referred to previously as constructive skepticism: there is an attitude of caution and reserve in coming to conclusions coupled with the insistence that, although some things (real mechanical causes) cannot be known, there is some evidence to which belief should be proportioned. Depending upon the kind and authenticity of the evidence, the degree of belief or certainty is greater or less.

In the course of the present chapter the theory of certainty originally developed with respect to theological controversies in the writings of Chillingworth and Tillotson has undergone a change in the extent of its development and in the context of its presentation. In the writings of Wilkins the theory was formulated relatively independently of theological controversies, but not independently of a theological context. In Glanvill's writings the views fully presented by Wilkins are restated in the context of the theory of science; the theory of certainty has been secularized. The theory as stated by Glanvill represents, on the one hand, a non-theological setting of the theory expressed by Wilkins, and on the other, is substantially the view accepted by the Royal Society. In Glanvill's writings the theory found little direct application in genuine scientific achievements, except in his speculations concerning witches. It remains now to see how the theory is applied in bonafide scientific discoveries by two of the foremost English scientists of the seventeenth century, Robert Boyle and Isaac Newton.

CHAPTER IV

THE THEORY OF CERTAINTY IN ITS SCIENTIFIC CONTEXT

Joseph Glanvill had presented in rather full detail the theory of certainty generally accepted by the Royal Society, but had not taken the further step of applying it to the physical sciences. This significant step was taken by his friend Robert Boyle and by Sir Isaac Newton; in the presentation of their scientific results the view is put forward that scientific conclusions do not make known nature's inner structure and are not absolutely certain.

In the period under consideration we have been trying to show that the views developed in theological controversies about the certainty of knowledge affected scientific theory as well, and in fact were a cause for the re-examination of scientific theory in seventeenth century England. Within the scope of Boyle's writings the transition finds an explicit expression; his account of the certainty of knowledge is presented in the main in his theological writings but is applied to his discoveries in the sciences. In examining Newton's account of science an attempt will be made to show that, although he is generally presented as among the foremost in the development of a new method in the empirical sciences, the views he actually presents had already been developed in the Royal Society and were a continuation of that tradition. Indeed, so far as the theory of certainty is concerned, Newton's views, as will be seen, were less explicitly formulated than those of his contemporaries and were also truncated in expression as compared with theirs.

There is a difference between the presentation of the theory of certainty as formulated by Wilkins and Glanvill on the one hand and Boyle and Newton on the other which should be noted. In the former, the attempt to establish the theory was made in relatively small compass – Wilkins presenting his views in the opening chapters of *Natural Religion* and Glanvill his in the *Vanity of Dogmatizing* and a few

of his *Essays*. On the contrary, the ideas of Boyle and Newton concerning certainty are scattered throughout their writings. As a consequence of this fact, the account given in this chapter of their views is an organization not explicitly found in their writings but a systematization of ideas which are sometimes scattered almost at random among theological arguments and scientific results.

SECTION I

ROBERT BOYLE

Of the life of Robert Boyle (1627–1691) little needs to be said since he is known for his scientific achievements and several excellent biographies are readily available.¹ He was born in Lismore, Ireland, the youngest son in an extremely wealthy family. In 1638 he and a brother were sent abroad with a tutor; Paris and Lyons, Geneva, and the cities of Italy were the main places visited. Because the money sent for their return to Ireland was stolen the two boys stayed in Geneva until 1644. Soon after his return to England and while still in his teens Boyle began meeting with the Gresham College experimenters, meetings which were eventually to culminate in the formation of the Royal Society. His presence was often required at his estates in Ireland, but he seemed always to gravitate towards London and the experimenters located there. It was probably in this period that he and Wilkins met, a friendship which led to his being invited by Wilkins in 1653 to come to Oxford. His primary interests was in chemistry, but his experiments with the air pump, beginning in 1657, led to the publication of *New Experiments Physico-Mechanical Touching the Spring of the Air and its Effects*² in 1660 and the formulation of the law which bears his name.

Combined with his insatiable curiosity about the secrets of nature was an intense interest in religion. During his stay at Oxford he spent a good deal of time learning Greek, Hebrew, Arabic, and Chaldean so as to be able to read religious documents in the original. One of his

¹ For a fuller account of Boyle's life and interests see Birch's account prefixed to his edition of *The Works of the Honourable Robert Boyle* (cited in this chapter as the *Works*). Another account of Boyle's life, but one which tends to emphasize his goings and comings at the expense of a developed account of his intellectual interests, is Flora Masson's *Robert Boyle: A Biography* (London, 1914).

² The law which bears Boyle's name was not announced in this publication, but in an essay, *Defense Against Linus* (London, 1662), written in answer to objections raised by a Jesuit, Franciscus Linus (1595–1673), against his views on the elasticity of the air.

interests in this connection was a cautious examination of stories about witches and apparitions, concerning which his friend Glanvill requested that he prepare a report for a forthcoming book. Among other projects were the contribution of a large sum of money for the printing of the Welsh, Irish, and American Indian Bibles, his presidency of the Society for the Spread of the Gospel in New England, and the writing of numerous essays and tracts on religious subjects. By the terms of his will the Boyle Lectures were established, their purpose being to prove the truth of Christianity against atheists, pagans, Jews, and Mohammedans, though with the proviso that controversies among Christians were not to be mentioned.

In examining Boyle's thought no account will be taken of his scientific achievements, notable though they are, nor of his view of 'scientific method' insofar as it involves the formulation and verification of hypotheses and theories. An inquiry into the latter would carry us beyond the scope of our study and has been done already.³ Our interest will rather be directed towards discovering what kind of certainty about the workings of nature Boyle expected to get from application of his method. In considering his view on the certainty of science his account of man's native faculties will be examined first, followed by his evaluation of accepted and current scientific theories and his views on kinds of certainty and their relation to evidence. Since Boyle often discusses scientific problems in theological contexts and raises issues concerning certainty in theological discussions, frequent reference will be made to his theological writings.

Boyle acknowledges in *The Reconcilableness of Reason and Religion*⁴ his indebtedness to Descartes and Bacon for his views on the limitations of human nature. Descartes' *Principles* and *Meditations* and Bacon's *Novum Organum* are cited as having shown fully and clearly the

³ For accounts of Boyle's scientific method see Richard S. Westfall, "Unpublished Boyle Papers Relating to Scientific Method," *Annals of Science*, XII (1956), 63-73 and 103-117; Dorothea Krook, "Two Baconians: Robert Boyle and Joseph Glanvill," *The Huntington Library Quarterly*, XVIII (1955), 261-278; Marie Boas, "Boyle as a Theoretical Scientist," *Isis*, XLVI (1950), 261-268; and Marie Boas, *Robert Boyle and Seventeenth Century Chemistry* (Cambridge, 1958).

⁴ *Some Considerations About the Reconcilableness of Reason and Religion* was first published in 1675. The title page gives the author as "T. E., a Layman," which letters are presumably the last letters in the two parts of Boyle's name. In the Preface to this essay the author notes that earlier opponents to religion had challenged the historical and doctrinal parts of Christian theology, but that in his own time they were challenging the basic principles of natural religion - the existence of God, providence, and immortality. The latter opponents, he writes, develop their arguments from a scientific basis, the Epicurean doctrine that everything is explicable in terms of matter and motion. This is of a significance because the mechanical philosophy Boyle was interested in developing was based on the same principles, though limited by him to the realm of nature alone. See *Works*, IV, 154-155.

effects of education and prejudice and of the fallibility of the senses and reason on knowledge. The innate tendency of the mind to consider itself the measure of truth and reality is particularly noted as being destructive of any attempt to find out what is true of nature. The innate idols of the tribe are cited as predisposing the mind to error and as being virtually ineradicable. Boyle points out that for Christians the situation is further complicated – or, rather, received its initial complication – by the Fall of Adam, which, arising from man's desire to know, resulted in his being deprived of knowledge. This indisposition to knowledge extends not only to the subject matter of morality and politics, but the physical sciences and theology as well.⁵ The faculties are so seriously affected by prejudice, passion, and inherent disability that all knowledge, even that based upon the principles of right reason, is suspect:

... yet really our intellectual weaknesses, or prejudices, or prepossessions by custom, education &c, our interest, passions, vices, and I know not how many other things, have so great and swaying an influence on them [the faculties] that there are very few conclusions, that we make, or opinions, that we espouse, that are so much the pure results of our reason, that no personal disability, prejudice, or fault, has any interest in them ... the very body of mankind may be embued with prejudices, and errors, that from their childhood, and some also even from their birth, by which means they continue undiscerned, and consequently unreformed.⁶

Boyle considers it an open possibility that what men regard as scientific truth may in fact be false and this for several reasons. First, there are the general ones cited above, namely the Fall of Adam which subjects all men to error, and the liability to prejudice, passion, and vice which may affect the processes of thought. The second is that since the course of nature depends completely upon God's will, man made laws may be inapplicable the very moment they are formulated, for if "we consider God as the author of the universe, and the free establisher of all the laws of motion ... we cannot but acknowledge, that, by with-holding his concurrence, or changing these laws of motion, which depend perfectly upon his will, he may invalidate most, if not all the axioms and theorems of natural philosophy."⁷ Miracles are historical instances in which such laws have been temporarily invalidated: the survival of Daniel's three friends in the fiery furnace, the several instances of resurrection, and the virgin birth are cited. Boyle also uses the argument (also used by Glanvill in the *Vanity of Dogma-*

⁵ *Ibid.*, p. 165.

⁶ *Ibid.*, p. 164.

⁷ *Ibid.*, p. 162.

tizing) that what all men regard as a contradiction may not be so to God; man's reasoning depends upon his using rules of thought, and what seems impossible by human rules may well be possible by God's.⁸

One possible way out of the difficulties for scientific knowledge raised by such considerations as these is to appeal to revelation as an unimpeachable source of truth. God is infallible, says Boyle, and whatever he reveals is certainly true and worthy of belief. However, revelation itself is no absolute guarantee of truth, for "even as to revelations themselves, I allow reason to judge of them before she judges by them."⁹ Since reason is admittedly affected by education, the passions, and its own inherent limitations, there is no guarantee that it correctly judges what is a revelation:

And lastly, if even in purely physical things, where one would not think it likely, that rational beings should seek truth with any other design than of finding and enjoying it, our understandings are so universally biased and imposed upon by our wills and affections; how can we admire, especially if we admit the fall of our first parents, that our passions and interests, and oftentimes our vices, should pervert our intellects about those revealed truths, divers of which we discern to be above our comprehensions, and some of which we find to be directly contrary to our inclinations?¹⁰

The fact that skeptical arguments can be raised against most claims to knowledge, whether scientific, moral, or religious, does not compel Boyle to conclude that despair is justified. On the contrary, skepticism is justified only insofar as positive uses are made of it. This is particularly so in the sciences. In *The Sceptical Chymist*¹¹ arguments are used to show that the Aristotelian and Paracelsan theories are not as well founded as their adherents claim; the doctrines of the four elements (earth, water, air, and fire) and the three principles (salt, sulphur, and mercury) can be challenged on both experimental and theoretical grounds. Boyle's purpose in arguing against such theories is to show that accepted theories of nature are not as well founded as their proponents claim:

⁸ *Vanity of Dogmatizing*, p. 195. Boyle also cites in this connection two examples from Descartes, that on man's principles it is inconceivable that there could be a valley without a mountain, or that two and one are not equal to three.

⁹ *Reconcilableness of Reason and Religion, Works*, IV, 155; see also pp. 163 and 168. Boyle denies the double truth theory, maintaining rather that what is given in revelation is true, though in our present human situation we may not be able to understand such truths. The truths of religion are often said to transcend but not to contradict reason. In his *Science and Religion in Seventeenth Century England*, Westfall examines at some length Boyle's views on the relation between reason and faith; see especially pp. 167-174.

¹⁰ *Reconcilableness of Reason and Religion, Works*, IV, 165-166.

¹¹ This book was first published in 1661, but a manuscript version seems to have been in circulation before then.

In case that some of his [Carneades, Boyle's spokesman] arguments shall not be thought of the most cogent sort, that may be, he hopes it will be considered, that it ought not to be expected, that they should be so. For his part being chiefly but to propose doubts and scruples, he does enough, if he shews, that his adversaries arguments are not strongly concluding, though his own be not so neither ... it is not necessary, that all the things a sceptic proposes should be consonant; since it being his work to suggest doubts against the opinion he questions, it is allowable for him to propose two or more several hypotheses about the same thing ... Because it is enough for him, if either of the proposed hypotheses be but as probable as that he calls in question ... And our *Carneades*, by holding the negative, has this advantage, that if among all the instances he brings to invalidate the vulgar doctrine of those he disputes with, any one be irrefragable, that alone is sufficient to overthrow a doctrine which universally asserts what he opposes.¹²

The skeptic himself does not attempt to construct a new theory; his function is simply to demolish established ones by showing that alternative accounts of the same phenomena can be given. Since this can be done, no theory can claim either universal acceptance or absolute certainty. Boyle is arguing that in science neither the Aristotelian nor Paracelsan theory is an adequate basis for certain knowledge of nature. In an essay, *Some Considerations touching the Usefulness of Experimental Philosophy*,¹³ he makes another target of his attack the contemporary Epicurean atomists and materialists, probably including Hobbes, who claim to have given full and complete explanations of nature's events. Their theories he finds deficient in two respects. In the first place, although they can give consistent and plausible accounts of observed phenomena in terms of matter and motion, they are mistaken in dogmatically asserting that these two principles must be

the true and genuine cause of the things they attempt to explicate ... For as an artificer can set all the wheels of a clock a going, as well with springs as with weights ... so the same effects may be as well produced by divers causes different from one another; and it will oftentimes be very difficult, if not impossible, for our dim reasons to discern surely, which of these several ways ... she has really made use of to exhibit them ... and that it is a very easy mistake for men to conclude, that because an effect may be produced by such determinate causes, it must be so, or actually is so.¹⁴

¹² *The Sceptical Chymist*, Works, I, 460-461; see also the dialogue, "Of the Positive or Privative Nature of Cold," Works, III, 733-756.

¹³ Robert Boyle, *Some Considerations touching the usefulness of Experimental Philosophy*. Different parts of this work were published from 1663 to 1671.

¹⁴ *Ibid.*, Works, II, 45. In the same connection Boyle asks how the atomist knows that God, whose ways and wisdom infinitely transcend man's, makes things in such a way that their structure corresponds to the categories of finite human reason (p. 46), which question, so long as it remains unanswered, precludes man's knowing with certainty the real structure of nature. Boyle's metaphor of the clock and the suggestion that there may be more than one explanation of its functioning also occurs in Descartes, *The Principles of Philosophy*, Part IV, Principle CCIV, as found in *The Philosophical Works of Descartes*, trans. E. S. Haldane and G. R. T. Ross, 2 vols. (New York, 1955), I, 300.

To the claim of the dogmatic materialists that their explanations (or, as Boyle prefers, their explications), are the only true ones Boyle replies that it has not been proved that the real causes of things are those expressed in the theory which is simplest in structure. Second, even if the account of nature in terms of matter and motion were adequate as a general explanation, it would not suffice as science, for what scientific explanation requires is an account of each particular event in such a way as "to declare what precise, and determinate figures, sizes, and motions of atoms, will suffice to make out the proposed phenomena, without incongruity with any others to be met with in nature."¹⁵

Boyle is not, however, content to leave the matter of man's inability to understand nature either with the implication that no certain knowledge can be had, or at the impasse of not settling for any of several possible general theories. The skeptical approach is unsatisfactory; an attempt must be made to go beyond it:

The last advertisement I desire to give the reader, concerns [my] intention ... For though sometimes I have had occasion to discourse like a Sceptick, yet I am far from being one of that sect; which I take to have been little less prejudicial to natural philosophy than to divinity itself. I do not with the true Scepticks propose doubts to persuade men, that all things are doubtful and will ever remain so (at least) to human understandings; but I propose doubts not only with design, but with hope, of being at length freed from them by the attainment of undoubted truth, which I seek that, I may find it; though if I miss of it in one opinion, I proceed to search after it in the opposite, or in any other where it seems more likely I should meet with it.¹⁶

Boyle compares the search for truth to a man who is given a bag of coins some of which he suspects to be counterfeit. Being reasonable he does not throw all the coins away but examines and tests them one by one, keeping those that are sound, throwing away those that are wholly false, and melting down for the good metal they contain those that are alloyed. He proposes, then, a moderate sort of skepticism, a challenging of beliefs not for the sake of rejecting them but to discover truth. He admits with Descartes and Bacon the virtual impossibility of attaining unexceptionable truth about nature. He challenges proposed theories not on the ground that all evidence is unsuitable to produce conviction, but on the ground that the evidence for accepted theories is not such as to warrant the undoubted certainty claimed. Every proposed explanation of natural events is to be

¹⁵ *Some Considerations touching the usefulness of Experimental Philosophy, Works, II, 45.*

¹⁶ *Sceptical Chymist, Works, I, 591.* The statement is from an Appendix added to the 1679 edition in answer to the objection that in rejecting all theories he was not making a positive contribution to science.

examined thoroughly; what is well-founded is to be accepted, the rest rejected.

Since for Boyle certainty depends in part upon the sources of knowledge, an examination of the latter will throw some light on the former. In *The Christian Virtuoso*,¹⁷ in which he attempts to show that experimental science and Christianity are not incompatible, and in which his views on the present subject are most fully presented, he acknowledges two sources, experience (comprised of sense perception, testimony, and revelation) and reason. In the main Boyle is an empiricist for he claims that most of our knowledge depends upon the senses,¹⁸ but in saying this, reason is not to be deprecated for by it the information of the senses is judged.

Experience is either immediate or vicarious. Immediate or personal experience is that which is acquired directly through the external or internal senses, and by it one knows, for example, that fire is bright and hot, that snow is white and cold, that one feels hunger, that one loves what he thinks good, and that a square is not a triangle.¹⁹ How the senses operate to produce such knowledge, together with the interaction of the soul and body, he suggests in another essay, are problems which "never yet, nor perhaps ever will be, in this life clearly understood."²⁰ A mechanical explanation can be proposed, but how physical changes in sensory nerves produce images is not understood. Further, the senses are often deceived, as in the case of the stick which appears bent when half immersed in water and of the square tower which appears round when seen at a distance, though when conditions of distance, medium, and so on are corrected compensations can be made. In an unpublished set of notes he remarks: "That Sense is not lightly to be distrusted in its Positive Informations when the Organs being well qualify'd, 'tis conversant about its proper objects."²¹ Further, as a practicing scientist he is aware of the utility of instruments in making observations: "That the Informations of Sense assisted and highlighted by Instruments are usually preferrable to those of Sense alone."²² In making the senses a primary source of knowledge Boyle does not ascribe to them an autonomous role, nor are they to be ranked

¹⁷ Robert Boyle, *The Christian Virtuoso*. This work was first published in 1690.

¹⁸ Robert Boyle, *The Origin of Forms and Qualities*, Works, III, 11.

¹⁹ *Christian Virtuoso*, Works, V, 525.

²⁰ *Reconcilableness of Reason and Religion*, Works, IV, 159; see also *A Discourse of Things Above Reason*, Works, IV, 412. It is worth noting here that Glanvill had also dealt with these questions at great length in the *Vanity of Dogmatizing*.

²¹ Westfall, "Unpublished Boyle Papers," p. 114.

²² *Ibid.*, p. 115.

higher than reason. The relation between the senses and reason is put succinctly: "The Organs of Sense are but the Instruments of Reason in ye Investigation of Truth."²³ Little indeed can be known without the senses, but their pronouncements are subject to the authority of reason. In a dialogue concerning the quality cold his spokesman in reply to an objection says:

... experimental philosophers do not prefer the immediate impressions made on the senses to the dictates of reason, though they think the testimony of the senses, however sometimes fallacious, much more informing than the dictates of Aristotle. ... I will represent to you, that the organs of sense, considered precisely as such, do only receive impressions from outward objects, but not perceive what is the cause and manner of these impressions, the perception, properly so called, of causes properly belonging to a superior faculty, whose property it is to judge, whence the alterations made in the sensories do proceed.²⁴

The second source of information, vicarious experience, includes testimony and revelation. Testimony is the primary source for knowledge of such matters of fact as are relevant to history, law, commerce, religion, and so on: "It is by this we know, that there were such men as *Julius Caesar* and *William the Conqueror*, and that *Joseph* knew that *Pharaoh* had a dream, which the Egyptian wise men could not expound."²⁵ An acceptable witness must fulfill three qualifications: he must have knowledge of that to which he testifies, he must be faithful in reporting what he knows, and must be of good moral character.²⁶ Revelation, the other kind of experience, is that "by which we know, what, supposing there is some divine revelation, God is pleased to relate or declare concerning himself, his attributes, his actions, his will, or his purposes."²⁷ On rare occasions such revelation is immediate, usually it is received through the mediation of apostles, prophets, or angels. In the latter case, of course, the considerations concerning testimony apply. Whether an immediate revelation could be false Boyle does not say, though if his earlier statement about reason judging which experiences are to be taken as revelations is applicable here, it would seem error could occur even here.

Over all these forms of experience Boyle argues that reason has authority, for "experience is but an assistant to reason, since it doth indeed supply information to the understanding; but the understanding remains still the judge, and has the power or right to examine and

²³ *Ibid.*, p. 113.

²⁴ "Of the Positive or Privative Nature of Cold," *Works*, III, 740; see also the *Christian Virtuoso*, *Works*, V, 539.

²⁵ *Christian Virtuoso*, *Works*, V, 525.

²⁶ *Ibid.*, p. 529; see also Westfall, "Unpublished Boyle Papers," p. 116.

²⁷ *Christian Virtuoso*, *Works*, V, 525.

make use of the testimonies that are presented to it.”²⁸ Reason is endowed with a set of principles with which it evaluates and accepts or rejects whatever information is presented. Also, it can challenge the principles of any of the particular sciences since each is based upon one of the above mentioned sources of information. This, Boyle realizes, involves a problem of criteria for one is faced with the problem of determining the justification for the conclusions of each of the sciences. In *A Discourse of Things Above Reason* this problem is specifically considered. In this book, written in dialogue form, statements are introduced the truth of which seems beyond question, but how the principle involved is to be explained remains incomprehensible. He cites instances taken from different fields, for example, that God exists and is infinite, that matter is infinitely divisible, and that the diagonal of a square is incommensurable with its sides. An opponent then raises the question that if the accepted principles of reason formed by reflection on experience in the development of the sciences are not to be taken as the criteria by which to judge of these “things above reason,” then “by what rules [shall we] judge of those rules, and discover them to be erroneous in case they be so, and by what measure [shall we] estimate truth and falsehood, in those things, wherein the use of those rules must be laid aside?”²⁹

The question is recognized as legitimate, and an attempt is made by way of answer. An infinite regress in criteria of truth would be an impossibility since there would then never be a resolution of any problem. The criterion, if there is one, must be discoverable and immediately applicable. Boyle’s voice in the dialogue speaks:

... in my opinion, since there is no progress *in infinitum* in the criteria of truth, and that our faculties are the best instruments, that God has given us to discover and examine it by; I think a clear light, or evidence of perception, shining in the understanding, affords us the greatest assurance we can have (I mean in a natural way) of the truth of the judgments we pass upon things, whether they be other things, or the vulgar rules of reasoning, or subjects, that claim a privilege from these rules.³⁰

The rational faculty possesses an innate light by which it sees certain principles as true or false. To demand a standard for this light would

²⁸ *Ibid.*, p. 539. In Westfall, “Unpublished Boyle Papers,” pp. 113–114, there are three comments which indicate the role of reason: “That Arguments drawn from Reason are preferred to those drawn from Authority,” “That the Organs of Sense are but the Instruments of Reason in ye Investigation of Truth,” and “That when Reason proceeds in a due manner, upon true Metaphysicall and Mathematical grounds, its conclusions are to be preferr’d to some of the Testimonies of Sense.”

²⁹ *A Discourse of Things Above Reason, Works, IV, 460.*

³⁰ *Ibid.*

higher than reason. The relation between the senses and reason is put succinctly: "The Organs of Sense are but the Instruments of Reason in ye Investigation of Truth."²³ Little indeed can be known without the senses, but their pronouncements are subject to the authority of reason. In a dialogue concerning the quality cold his spokesman in reply to an objection says:

... experimental philosophers do not prefer the immediate impressions made on the senses to the dictates of reason, though they think the testimony of the senses, however sometimes fallacious, much more informing than the dictates of Aristotle. ... I will represent to you, that the organs of sense, considered precisely as such, do only receive impressions from outward objects, but not perceive what is the cause and manner of these impressions, the perception, properly so called, of causes properly belonging to a superior faculty, whose property it is to judge, whence the alterations made in the sensories do proceed.²⁴

The second source of information, vicarious experience, includes testimony and revelation. Testimony is the primary source for knowledge of such matters of fact as are relevant to history, law, commerce, religion, and so on: "It is by this we know, that there were such men as *Julius Caesar* and *William the Conqueror*, and that *Joseph* knew that *Pharaoh* had a dream, which the Egyptian wise men could not expound."²⁵ An acceptable witness must fulfill three qualifications: he must have knowledge of that to which he testifies, he must be faithful in reporting what he knows, and must be of good moral character.²⁶ Revelation, the other kind of experience, is that "by which we know, what, supposing there is some divine revelation, God is pleased to relate or declare concerning himself, his attributes, his actions, his will, or his purposes."²⁷ On rare occasions such revelation is immediate, usually it is received through the mediation of apostles, prophets, or angels. In the latter case, of course, the considerations concerning testimony apply. Whether an immediate revelation could be false Boyle does not say, though if his earlier statement about reason judging which experiences are to be taken as revelations is applicable here, it would seem error could occur even here.

Over all these forms of experience Boyle argues that reason has authority, for "experience is but an assistant to reason, since it doth indeed supply information to the understanding; but the understanding remains still the judge, and has the power or right to examine and

²³ *Ibid.*, p. 113.

²⁴ "Of the Positive or Privative Nature of Cold," *Works*, III, 740; see also the *Christian Virtuoso*, *Works*, V, 539.

²⁵ *Christian Virtuoso*, *Works*, V, 525.

²⁶ *Ibid.*, p. 529; see also Westfall, "Unpublished Boyle Papers," p. 116.

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²⁹ *A Discourse of Things Above Reason, Works*, IV, 460.

³⁰ *Ibid.*

start an infinite regress; the light is simply there, and by it one judges of all else. The mind is analogous to the eye: just as the eye sometimes uses mechanical instruments and sometimes sees its objects directly, so the mind sometimes uses rules of reasoning to arrive at conclusions but at some time must judge directly of the rules themselves. Reason knows, "immediately, and, as it were, intuitively, by evidence of perception"³¹ such metaphysical axioms as that contradictory propositions cannot both be true, that from truth nothing but truth can legitimately be deduced, and such mathematical axioms as that equals added to equals are equal and that every number is either odd or even. This light of the intellect, imprinted in the soul by an act of God, is then, if correctly used, the ultimate standard of truth. All the principles of reason and the conclusions derived from them are ultimately judged by it. Once an appeal has been made to what has been immediately presented to reason nothing further can be asked. It does not follow, however, that reason can discover all truth. Like the senses, reason has its limitations. There are some things which are simply beyond its powers of comprehension: "That as to some things, even in Natural Philosophy, 'tis disputable whether Reason be able to comprehend and judge them."³² In such cases the function of reason is simply to judge that they are incomprehensible and not to comprehend them.

In this particular discussion Boyle does not raise the question whether this light of the understanding could be mistaken in identifying as true the axiom, e.g., that two contradictory statements cannot both be true. His earlier discussion of the weakness of reason had been limited to the conclusions of morals and politics, physical science and theology, so the conclusions reached there about fallibility of reason are not necessarily applicable here. Nor does he in this connection make it a postulate, as had More and Wilkins, or an act of faith, as had Glanvill, that the faculties do not deceive when one thinks he understands something with a maximum of clarity. He simply states that it is the light of the understanding which judges of truth and falsity. So whether Boyle will admit that all our knowledge may be false remains an unanswered question, unless one takes his earlier remarks about the effects of the passions, prejudice, and the inherent disabilities of the mind to be intended to apply to all thought.

Boyle seems, then, to recognize as a real possibility that all knowledge

³¹ *Ibid.*, p. 461. The comparison of the mind's seeing truth to the eye's seeing an object immediately presented to it is not a unique one in Boyle. See, for example, Descartes' *Principles of Philosophy*, Part I, Prin. XLV, in the *Philosophical Works of Descartes*, I, 237.

³² Westfall, "Unpublished Boyle Papers," p. 113.

(the possible exception above to be noted) may in fact be false. He is unwilling to acquiesce in such a skeptical view, however, and therefore proposes in the spirit of Chillingworth, and as had his friends in the Royal Society, a theory involving levels of certainty based upon kinds of evidence. His views on certainty are presented in an essay, *The Excellence of Theology*, whose subject matter is revealed in its subtitle, *the Pre-eminence of the Study of Divinity over that of Natural Philosophy*. It is written in the form of a letter to a Dr. N. who has a friend who is a Cartesian; the friend thinks that science has more certainty than does theology, and this Boyle proposes to show is false. His major argument against the Cartesian friend is that for any fundamental doctrine of religion only a moral certainty can be had since it is unreasonable that God should propose for belief truths which a studious and serious thinker cannot understand. Science, for its part, admits of no greater certainty for it is made up of hypotheses only. His discussion of the several kinds of proof and their attendant degrees of certainty Boyle recognizes to be quite brief, "a subject, that I judge far more considerable than cultivated." Besides the demonstrations "wont to be treated of in vulgar logick," says Boyle, there are three kinds of demonstration, each with its attendant degree of certainty. First, there is metaphysical demonstration which is based upon general axioms which cannot be other than true, for example, nothing can at the same time both be and not be and no non-entities are real properties. Such demonstrations as are based on this sort of principle yield metaphysical certainty, a certainty "wherein it is absolutely impossible that the thing believed should be other than true."³³ Boyle does not explain why it is impossible for such propositions to be false, nor does he indicate whether one could err in identifying them, thus leaving the possibility of complete skepticism an open question. The second level of proof is physical demonstration, in which the conclusions are deduced from such physical principles as, for example, from nothing comes, and no substance returns into nothing. Such principles are true of nature so far as human knowledge is concerned. It is scientifically inconceivable that something should come from nothing, but, says Boyle, this is not absolutely so for all Christians believe that God created the world from nothing, and that Christ brought Lazarus back to life. Hence it is within the realm of possibility that the principles and conclusions of physical or scientific demonstrations could be false. Physical demon-

³³ *Excellence of Theology, Works, IV, 42*. The examples are from the *Reconcilableness of Reason and Religion, Works, IV, 182*.

stration is built upon the supposition that certain principles are true, but since God can perform miracles which violate such principles scientific laws and theories may possibly be false.

The third kind of proof, moral demonstration, occurs "when the conclusion is built either upon some one such proof cogent in its kind, or some concurrence of probabilities, that it cannot be but allowed, supposing the truth of the most received rules of prudence and principles of practical philosophy."³⁴ Moral certainty, as based upon deductions from the "received rules of prudence and principles of practical philosophy," is the kind of certainty obtainable in most of the affairs of life; it "is enough in many cases for a wise man, and even a philosopher to acquiesce in."³⁵ Men's private affairs, the courts, the affairs of state are all conducted with a level of certainty no greater than this.³⁶ In the *Reconcilableness of Reason and Religion* Boyle proposes that moral certainty is all that is required in religion: "those articles of the Christian religion, that can be proved by a moral, though not by a metaphysical or physical demonstration, may without any blemish to a man's reason, be assented to."³⁷ Just as any basic principle may be assented to "without any blemish to a man's reason," so too assent can be given to whatever is deduced from such principles. In this connection Boyle, like Tillotson and Wilkins, makes use of a wager-type argument, pointing out that prudence does not always require one to refuse to act on grounds which are less than morally certain. On such occasions it seems better "to take that resolution, which upon the whole matter seems to be preferable to any other; though that, which is thus preferred, may perhaps be liable to some objections, that cannot be directly answered, but only obliquely, by the preponderancy of the arguments, that persuade the choice, against which the objection is made."³⁸

³⁴ *Reconcilableness of Reason and Religion, Works, IV, 182.*

³⁵ *Excellence of Theology, Works, IV, 42.*

³⁶ Boyle makes particular application of the doctrine of moral certainty to legal affairs. In the *Reconcilableness of Reason and Religion* he points out that there are some particular items which of themselves seem only probable, but when taken together amount to a certainty, and cites an instance in law: "... the practice of our courts of justice here in *England*, affords us a manifest instance in the case of murder, and some other criminal cases. For, though the testimony of a single witness shall not suffice to prove the accused party guilty of murder; yet the testimony of two witnesses, though but of equal credit, that is, a second testimony added to the first, though of itself never a whit more credible than the former, shall ordinarily suffice to prove a man guilty; because it is thought reasonable to suppose, that though each testimony single be but probable, yet a concurrence of such probabilities, (which ought in reason to be attributed to the truth of what they jointly tend to prove) may well amount to a moral certainty, *i.e.*, such a certainty, as may warrant the judge to proceed to the sentence of death against the indicted party" (*Works, IV, 182*).

³⁷ *Ibid.*, p. 183.

³⁸ *Ibid.*; see also p. 184.

Physical and moral certainty are "but an inferior kind or degree of certainty," since the principles upon which each is based are not true beyond exception. Scientific matters for Boyle properly give rise to physical certainty when all conditions are at their best, but this is a maximum not always reached. For the most part only moral certainty is attainable. The attempt of Descartes and other physicists, for example, to prove that certain comets are not meteors on the ground that their parallax is less than that of the moon can have only a moral certainty, for they have not themselves made the relevant observations but depend upon the reports of others. Problems about the reliability and authenticity of testimony can be raised, putting physical certainty out of the question. Presumably, if one made the observations himself, and was very careful in so doing, physical certainty could be attained.³⁹ Writing particularly of his own attempts to establish scientific results with certainty, Boyle remarks concerning his own conclusions in the "Proemial Essay" prefaced to *Certain Physiological Essays, and other Tracts*:

Perhaps you will wonder ... that in almost every one of the following essays I should speak so doubtingly, and so use often, *perhaps, it seems, it is not impossible*, and such other expressions, as argue a diffidence of the truth of the opinions I incline to, and that I should be so shy of laying down principles, and sometimes of so much as venturing at explications. But I must freely confess ... that having met with many things, of which I could give myself no one probable cause, and some things, of which several causes may be assigned so differing ... I have often found such difficulties in searching into the cause and manner of things, and I am so sensible of my own disability to surmount these difficulties, that I dare speak confidently and positively of very few things, except of matters of fact. And when I venture to deliver any thing, by way of opinion, I should, if it were not for mere shame, speak yet more diffidently than I have been wont to do.⁴⁰

To help clarify his views on proof and certainty Boyle proposes a set of "advices" which, though presented in his dialogue on things above reason, are relevant to his general position as it relates to the certainty of science. The first advice is that "*we do not admit any (affirmative) assertion, without such proofs, to evince it, as are sufficient in their kind.*"⁴¹ Any proof proposed as sufficient to sway assent must be of a certain kind:

since it is manifest, that there are many truths, such as historical and political ones, that, by the nature of the things, are not capable of mathematical or metaphysical demonstrations,

³⁹ Boyle notes that it is difficult to achieve physical certainty in the sciences, suggesting that most such conclusions are only morally certain. "... he will not scruple to acknowledge, that knows by experience, how much more difficult, it is, than most men imagine, to make observations about such nice subjects, with the exactness, that is requisite for the building of an undoubted theory upon them. And there are I know not how many things in Physicks, that men presume they believe upon physical and cogent arguments, wherein they really have but a moral assurance" (*Excellence of Theology, Works, IV, 42*).

⁴⁰ *Certain Physiological Essays and other Tracts, Works, I, 307*.

⁴¹ *A Discourse of Things Above Reason, Works, IV, 449*.

and yet, being really truths, have a just title to our assent; it must be acknowledged, that a rational assent may be founded upon proofs, that reach not to rigid demonstrations; it being sufficient, that they are strong enough to deserve a wise man's acquiescence in them.⁴²

There are involved here two principles both of which were used by other members of the Royal Society with whom he was well acquainted, Wilkins and Glanvill. In the first place there is the Aristotelian principle that to each kind of subject matter there corresponds an appropriate kind of proof.⁴³ This objective relation is not to be violated without foregoing the highest kind of certainty possible in that subject matter. This correlation of kind of proof to subject matter is again the justification for less than absolute certainty in matters of science; since matters of fact do not admit of mathematical but only of physical or moral proofs, only physical and moral certainty are within reach. Second, there is involved the principle that all truths are on a par; none is more true than any other, mathematical than historical, for example, and each can be assented to provided there is an adequate proof in kind.

The second and third "advices" are closely related to the first. The second is the converse of the first: not to be hasty in forming negative propositions or in rejecting the explanation of a privileged thing because it seems absurd.⁴⁴ In cases where the evidence is not such as to warrant assent to a positive proposition, suspension of judgment is the advised course. Negative propositions are justified under two conditions only: where they are drawn from metaphysically certain axioms or where there is a divine revelation. The third advice relates conceivability to belief. The existence of anything is prior to and independent of the mind's relation to it; just as visibility to the eye is no condition of the existence of an atom or of a magnetic field, so intelligibility to the understanding is no condition of the existence of things above reason, whether theological or scientific. Assent is justified if sufficient motive for belief by way of proofs can be provided, even though the matter in question is unintelligible or inconceivable. As Boyle puts it, so long as anything is proved by the best arguments available the mere fact that one does not understand its nature is inconsequential to the certainty had of it.⁴⁵

Boyle, "the father of chemistry," is, then, in his religious and scientific thought, interested in the problem of certainty. He is aware

⁴² *Ibid.*, p. 450.

⁴³ *Reconcilableness of Reason and Religion Works*, IV, 182-183.

⁴⁴ *A Discourse of Things Above Reason, Works*, IV, 452.

⁴⁵ *Ibid.*, p. 453.

of skeptical arguments that can be raised against any scientific theory, as he himself did in the *Sceptical Chymist*, but is not himself opposed to theory, only to indefensible ones. To the second English edition of the *Sceptical Chymist* (1676) an appendix was added in which he defends his use of skeptical arguments as simply a tool to achieve truth. In his "Proemial Essay," written as an introduction to *Certain Physiological Essays*, he disparages the making of hypotheses before making a sufficient number of experiments and observations, but acknowledges a proper use of reason: "Not that I at all disallow the use of reasoning upon experiments, or endeavouring to discern as early as we can the confederacies, and differences, and tendencies of things: for such an absolute suspension of the exercise of reasoning were exceeding troublesome, if not impossible."⁴⁶ No complete skepticism is possible, much less desirable. On the other hand, absolute certainty is difficult if not impossible to attain because of the fallibility of the senses and the weakness of reason. To carry on the scientific enterprise in such a milieu, Boyle makes use of the middle way which Chillingworth and Tillotson and he himself had used in matters of religion. Kinds of proof are proposed – metaphysical, physical, and moral – each with its attendant kind of certainty. The certainty of both religion and science is moral certainty, the kind had in the common affairs of life. For Boyle, as for Wilkins and Glanvill, the standards of certainty of the traveler, the jurist, and the merchant are made the basis for certainty in science as in religion. There is in Boyle a kind of mitigated but nonetheless constructive skepticism: a recognition that the real structure of nature is unknowable and a judicious proportioning of assent to evidence.

A comparison of Boyle's views with those of Bacon is instructive. For Bacon scientific conclusions give an insight into and understanding of the real structure of nature, the forms of simple qualities and of substances themselves. Boyle, on the contrary, does not expect his scientific conclusions to be an account of such real causes of things and events as the motion, shape, and size of minute, insensible particles. Though an admitted atomist who speaks of the "corpuscularean hypothesis" as his "favorite hypothesis," his atomism is just that, an hypothesis. Consequently, his explanations in terms of atoms, though based on such observed qualities as heat, fluidity, and weight, are still only hypothetical and therefore not absolutely certain accounts of the real structure of nature. The hypotheses developed are only morally

⁴⁶ *Certain Physiological Essays, Works, I, 303.*

certain – such as to convince a person who attentively considers all the available experimental evidence – and subject to modification when new evidence so demands. But insofar as they make nature intelligible and enable man to improve his condition in life, they are justified.

In Boyle one finds a development beyond both his friends, Wilkins and Glanvill. Wilkins had developed in considerable detail the theory of certainty originally stated by Chillingworth, but his exposition had been made in the context of religion. Glanvill had restated the theory, with minor emendations, and had secularized it, that is, presented the kinds and degrees of certainty as characteristic of scientific knowledge. He had applied the theory to the question of witches, but not to more orthodox scientific investigations. In Boyle the transition becomes complete, for within the scope of his writings the transition from the religious to the scientific formulation of the theory becomes a reality. The essays in which the problem of certainty is raised are primarily theological ones, but the conclusions to which he comes are consciously applied to his scientific results. It remains now to see how the theory finds expression in the writings of the greatest of the seventeenth century English scientists, Sir Isaac Newton.

SECTION II

ISAAC NEWTON

From his time to our own Sir Isaac Newton has been justifiably praised for his scientific achievements and has been credited with formulating the method of science and the temperament of the Royal Society. Typical is David Hume's accolade in his *History of England*, in which Newton is portrayed both as Britain's greatest scientist and as establishing with finality the limits of scientific inquiry. He writes:

In Newton this island may boast of having produced the greatest and rarest genius that ever arose for the ornament and instruction of the species. Cautious in admitting no principles but such as were founded on experiment; but resolute to adopt every such principle, however new or unusual ... While Newton seemed to draw off the veil from some of the mysteries of nature, he shewed at the same time the imperfections of the mechanical philosophy; and thereby restored her secrets to that obscurity, in which they ever did and ever will remain.⁴⁷

⁴⁷ David Hume, *The History of England, from the Invasion of Julius Caesar to the Revolution in MDCLXXXVIII*, 6 vols. (Philadelphia, 1796), VI, 290.

This general account of Newton's relation to the Royal Society, accepted in our own as in Hume's time, is inadequate in two respects as an accurate description of Newton's achievements. In the first place, some of the views about knowledge and certainty which find expression in his writings were initially developed by his predecessors in the Royal Society; although his philosophy of science has been examined by historians and philosophers of science, few have undertaken to show the relation of his views on certainty to the views developed earlier in the Society.⁴⁸

Second, his views were not stated with the same philosophical precision as had been the views of his predecessors in the Society, but were stated in truncated fashion in the formulation of his scientific results. Indeed, in Newton's writings there are seldom more than three or four consecutive sentences on the subject of certainty, and these are scattered throughout his writings. An examination of some of his scientific publications – on light and universal gravitation, and his hypotheses of particles and the ether – will show some of his views on method, particularly as it relates to certainty, to be a continuation of the theory developed earlier in the Royal Society. Since our interest is not primarily in an exposition of his scientific achievements, our account of them may well contain lacunae. As in the case of Boyle, our aim when dealing with Newton's scientific method will be to understand not so much the means as the end, the kind of knowledge and certainty to be achieved by the method. Finally, since Newton did not formulate his account of certainty with the precision of either Glanvill or Boyle, it will be necessary in some instances to state the theory and then show how it finds expression in his writings.

The accomplishments of "the incomparable Mr. Newton" (1642–1727) in celestial dynamics, his discovery of the universal law of

⁴⁸ Historians have for the most part not raised the question of the relation of Newton's views on certainty to those of other members of the Royal Society, though they have investigated the relation of his scientific discoveries and hypotheses to their views and to those of Galileo and Kepler. In his *The Metaphysical Foundations of Modern Physical Science* (New York, 1927), Edwin A. Burt does consider specifically Newton's views on the certainty of his conclusions, but relates him primarily to the Kepler, Galileo, Descartes tradition, although his relation to the experimental tradition of Bacon, Gilbert, and Boyle is also considered. In his *Franklin and Newton* (Philadelphia, 1956), I. Bernard Cohen discusses Newton's views on certainty in relation to his views on hypotheses, but since Cohen's interest is primarily in eighteenth century experimental Newtonianism the influence of Newton's predecessors' on his views is understandably not treated at length. Such standard histories as William Dampier's *A History of Science and its Relations with Philosophy and Religion* (New York, 1932) and Albert R. Hall's *The Scientific Revolution 1500–1800* (Boston, 1956) do not investigate the dependence of Newton upon the views of his contemporaries in the Royal Society with respect to the problem of certainty.

gravitation, and his work in optics have made him so well known that an extended account of his life is hardly needed here. This is particularly so since biographers have examined phases of his life in detail.⁴⁹ It will suffice here to recall only his relations with the Royal Society. Newton began making contributions to the *Philosophical Transactions* in 1671 and early in the next year was proposed for membership by Seth Ward. He was quite frequently present at the meetings during the first years of his membership. Among its members then were Robert Boyle, a good friend with whom he corresponded when away from London, and Robert Hooke, with whom he carried on an extensive controversy concerning his own theory of light. Through political connections he became a close friend of another member, John Locke. His *Mathematical Principles of Natural philosophy*⁵⁰ was first published in 1687 under the auspices of the Society which, however, was unwilling or unable to provide the financial backing necessary. *The Opticks*⁵¹ was first published in 1704. He was appointed to the Council of the Society in 1699 and four years later elected its president, a position he held for twenty-five years until his death.

In addition to his personal acquaintance with these men, Newton undoubtedly shared an intellectual kinship with them on many crucial issues relating to scientific and philosophical problems. Most of them had in one way or another been explicit in their views on the limitations of human knowledge because of either the obscurity of nature's inner workings or the fallibility and weakness of the faculties. A similar view of the limits of knowledge occurs in several of Newton's writings, though he does not develop in any detail the skeptical basis upon which they had founded their conclusions. In his early contributions to the *Philosophical Transactions*⁵² he presents the theory that white light is compounded out of several rays of light, each of which is

⁴⁹ Biographical accounts of note are to be found in *D. N. B.*, art. "Newton," Louis T. More's *Isaac Newton: a biography, 1642-1727* (New York, 1934); I. Bernard Cohen's *Franklin and Newton*, especially Chapter III; and E. N. Da C. Andrade, *Sir Isaac Newton* (Garden City, N. Y., 1958).

⁵⁰ Isaac Newton, *Mathematical Principles of Natural Philosophy And His System of the World*, English trans. of 1729 by Andrew Motte, revised and supplemented by Florian Cajori (Berkeley, 1946) - hereafter cited by its familiar title, *Principia*.

⁵¹ Isaac Newton, *The Opticks; or, A Treatise of the Reflections, Refractions, Inflections & Colours of Light*, Forward by Albert Einstein, Introd. by Sir Edmund Whittaker, and Preface by I. Bernard Cohen, based on 4th ed. of 1730 (New York, 1952) - hereafter cited as *Opticks*.

⁵² Newton's contributions to the *Philosophical Transactions* together with some other of his essays and letters are reproduced in facsimile in I. Bernard Cohen and Robert E. Schofield, *Isaac Newton's Papers & Letters on Natural Philosophy and related documents* (Cambridge, Mass., 1958). See especially No. 80, 19 February 1671/72, pp. 3075-3087 (Cohen and Schofield, pp. 47-59) for the initial presentation of his theory of the composition of light.

itself incapable of further analysis, as shown by his experiments with prisms. This account, says he, is certain, and can be proved by anyone willing to make the requisite experiments. However, it is an account only of the rays of light as they appear to the observer, colored, and not as they really are in themselves: "But, to determine more absolutely, what Light is, after what manner refracted, and by what modes or actions it produceth in our minds the Phantasms of Colours, is not so easie. And I shall not mingle conjectures with certainties."⁵³ The conclusions Newton thinks worthy of presentation to the public are only those which are experimentally discoverable and verifiable. To present an account of the nature of light and the causal nexus by which refraction and perception of colors occur, would be to present a speculative hypothesis, a conjecture which has no role in the formal presentation of a scientific theory. Such conjectures, or as he called them, hypotheses, he consciously and deliberately excluded from the body of his published works to avoid such controversies as were raised about his early contributions to the *Philosophical Transactions*. A somewhat similar view about the nature of light occurs in the *Opticks* where he points out that one of the most obvious characteristics of things, color, does not belong either to the object or to the ray of light producing it. In the light ray color is only a disposition to affect the sense organ in a particular way. Newton nowhere undertakes to show, except by way of questions to be further examined, how the motions of the rays produce the colors seen, nor the exact composition of the rays themselves. He limits himself to a descriptive account of how the rays of light are bent in passing through prisms, of correlations of colors to each of the several rays, and so on. Thus the real natures of light and colors remain unknown.

As in the case of light, so in the case of the other phenomenon he investigated so intensely, gravitation, Newton disclaimed having any understanding of its real nature or cause. He began his investigations of gravity as early as 1666, and in the preface to the first edition of the *Principia* (1687) wrote concerning the motions of the moon, the planets, and so on: "I am induced by many reasons to suspect that they [the motions] may all depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are ... mutually impelled towards one another ... These forces being unknown, philosophers have

⁵³ *Philosophical Transactions*, No. 80, 19 February 1671/72, p. 3085 (Cohen and Schofield, p. 57).

hitherto attempted the search of Nature in vain.”⁵⁴ He adds that he hopes the present work will clarify the situation somewhat, but apparently it did not, for in a letter of 1692–3 to Richard Bentley, who was then preparing the first Boyle Lectures, he wrote: “You sometimes speak of Gravity as essential and inherent to Matter. Pray do not ascribe that Notion to me; for the Cause of Gravity is what I do not pretend to know, and therefore would take more Time to consider of it.”⁵⁵ Considerable time was taken to think about it, but as late as 1713, when the second edition of the *Principia* was published, Newton could come to no positive conclusions as to its nature or causes. In the General Scholium added to that edition he still had to admit: “... hitherto I have not been able to discover the cause of those properties of gravity from phenomena, and I frame no hypotheses; ... and hypotheses, whether metaphysical or physical, have no place in experimental philosophy.”⁵⁶ The fact that its cause is not known is not taken as a sufficient reason for despair. Laws describing and predicting the motions of bodies can be made. It is enough, he says, that we know that gravity exists, is lawful, and serves to account for the motions of bodies. In attempting to account for gravitational motion in the twenty-first Query at the end of the *Opticks*, Newton suggests as one possibility (not as a formal part of his exposition) that the ether is the cause.⁵⁷ The ether he regards as made up of corporeal particles (about 490,000,000,000 times more elastic than ordinary air) which permeate all space and the pores between the particles of which bodies are made. This ether is progressively more dense the farther one is from the sun;

⁵⁴ *Principia*, Preface to the first edition, p. XVIII. In a letter to Boyle dated 28 February 1678/79, some nine years before publication of the *Principia*, Newton speculates on the cause of gravitational motion, suggesting, as a probable hypothesis, that it is caused by the ether. The letter is reprinted in Cohen and Schofield (pp. 250–253) from Birch’s *The Life of the Author in The Works of the Honourable Robert Boyle*, edition of 1744, I, 70–73.

⁵⁵ The letter is the second of four sent to Bentley who had written for help in the development of the first set of Boyle Lectures. The letter is dated 17 January 1692/93, and is reproduced in Cohen and Schofield, p. 298. In the third letter of the series, dated 25 February 1692/93, he offers a reason for denying the inherence of gravity in matter: “It is inconceivable, that inanimate brute Matter should, without the Mediation of something else, which is not material, operate upon, and affect other Matter without mutual Contact, as it must be, if Gravitation in the Sense of *Epicurus*, be essential and inherent in it. And this is one Reason why I desired you would not ascribe innate Gravity to me. That Gravity should be innate, inherent and essential to Matter, so that one Body may act upon another at a Distance thro’ a *Vacuum*, without the Mediation of any thing else, by and through which their Action and Force may be conveyed from one to another, is to me so great an Absurdity, that I believe that no Man who has in philosophical Matters a competent Faculty of thinking, can ever fall into it. Gravity must be caused by an Agent acting constantly according to certain Laws; but whether this agent be material or immaterial, I have left to the Consideration of my Readers” (Cohen and Schofield, pp. 302–303).

⁵⁶ *Principia*, General Scholium, p. 547.

⁵⁷ *Opticks*, Query 21, pp. 350–352.

and as the pressure of the ether is greater on the side of a planet away from the sun than on the side toward it, the planet is impelled toward the sun, thus accounting for the gravitational motion. The difficulty with this view, and Newton readily acknowledges it, is that it puts at one further remove an explanation of gravity, for the existence of this fluid substance is only an hypothesis, and "I do not know what this Aether is." ⁵⁸

The attitude that although the nature of gravity is unknown but that significant results can still be obtained by careful observation of gravitational motions and the formulation of laws, it should be noted, is the same as that taken by some other members of the Royal Society group whose views have been examined. Wilkins and Glanvill, for example, when trying to account for knowledge based upon the senses, admitted that they were ignorant of how sense perception occurred, particularly how physical impulses in the nerve centers could produce mental images. They concluded not that the senses were wholly untrustworthy and that no knowledge could be based upon them, but that if properly attended to they could give some certainty about the world. Similarly, Glanvill and Boyle lamented man's inability to know the real structure of nature, but were willing to settle for laws which are only descriptive of observed regularities. So too, Newton does not despair of gravity's existence from his inability to know its real nature or cause, but makes the best of the situation by confining himself to laying out its laws, for "... to us it is enough that gravity does really exist, and act according to the laws which we have explained, and abundantly serves to account for all motions of the celestial bodies, and of our sea." ⁵⁹

So far we have pointed out that according to Newton there are some things the scientist finds beyond the reach of intellect and whose natures must be acknowledged as unknown, particularly the nature of light and the cause of gravity, though speculative hypotheses can be devised to account for them. This reservation Newton carries further in his consideration of knowledge of bodies. Man's knowledge of material bodies, he says, is limited to an acquaintance with their sensible qualities; they are not known as they are in themselves. Their shapes and colors are observed, as well as their tactile qualities, sounds, and odors, "but their inward substances are not to be known either by our

⁵⁸ *Ibid.*, 352; see also A. R. Hall and M. B. Hall, "Newton's Theory of Matter," *Isis*, 51 (June, 1960) Part 2, 131-144.

⁵⁹ *Principia*, General Scholium, p. 547.

senses or by any reflex act of our minds ..." ⁶⁰ The ultimate reality of things is so hidden beyond appearances and so far exceeds man's capacities that the real world of primary qualities is always beyond the mind's grasp. This view Newton carries beyond the cases of light and gravity and the nature of physical objects to such questions as how matter was formed, how the sun and the planets got into their positions, and how the luminous particles which existed before the creation of the solar system got together in the sun. The only solution to such problems says Newton, is recourse to God; such events must have been the result of the activity of "the Counsel and Contrivance of a voluntary Agent." ⁶¹

Newton thus admits that the causes of such phenomena as light and gravity and of the real nature of bodies in general are not known. But this is not to say that he was not interested in discovering or trying to give an account of their natures. He does provide such an account of their natures, though admittedly speculative and of a lower degree of certainty than the formal results of his major investigations. His hypothesis of the particulate structure of matter underlies the *Principia* and is explicitly avowed in the *Opticks*.⁶² In his characterization of these particles, as we shall see below, his account of their properties is based upon knowledge of the properties of bodies within the range of man's experience. But since only the sensible and not the real properties of the latter are known, and from these (by analogy) the properties of the microscopic particles inferred, the mechanical principles underlying Newton's philosophy of nature are of little help in revealing the real structure of nature. The hypothesis is not itself a part of the results of either of the main works, since he will allow as results only what can be based upon observation and experiment; it nonetheless underlies both works in the sense that both are compatible with such a view, both contain references to it, and the *Principia* contains a mathematical version of it.

In Boyle's philosophy of nature a similar view, what he called the corpuscular hypothesis, was accepted and referred to as his "favorite hypothesis." There was no experimental, much less direct sensory evidence for such corpuscles, and in his case the hypothesis was a non-mathematical model to account for the characteristics of nature as

⁶⁰ *Ibid.*, p. 546.

⁶¹ Cohen and Schofield, p. 282; see also p. 284.

⁶² For an extended account of Newton's interpretation of the mechanical view of nature see Marie Boas, "The Establishment of the Mechanical Philosophy," *Osiris*, X (1952), 472-541, especially Sect. X, and Marie Boas and Rupert Hall, "Newton's 'Mechanical Principles,'" *The Journal of the History of Ideas*, XX (1959), 167-178.

observed. Realizing that the corpuscular hypothesis was only an hypothesis, Newton constructed his early theory of the composition of light so as to be compatible with both a particle and a wave theory, though his own inclinations seem to have been in favor of the former interpretation. He does go so far as to say that the particle theory of light is a consequence of his results, but generally, when discussing the nature of light, limits himself to a general account of it without claiming to know its real nature:

But I knew, that the *Properties*, which I declar'd of *Light*, were in some measure capable of being explicated not only by that [corporeal hypothesis], but by many other Mechanical *Hypotheses*. And therefore I chose to decline them all, and to speak of *Light* in *general* terms, considering it abstractly, as something or other propagated every way in streight lines from luminous bodies, without determining, what that Thing is.⁶³

In the *Principia* the particle theory plays an important though subdued role. Although he deals with the motions of such large bodies as the planets, the moon, and the ocean, what he has to say about them depends upon the doctrine of particles: "It is reasonable to suppose that forces which are directed to bodies should depend upon the nature and quantity of those bodies ... And when such cases occur, we are to compute the attractions of the bodies by assigning to each of their particles its proper force, and then finding the sum of them all."⁶⁴ Newton begins the *Principia* by developing mathematically the laws of motion and gravitation and their consequences. His program was then to show that observed phenomena agree with the laws, which, in the case of gravity, they do. But since the laws deal with mass located at a point, he could develop the theory of gravity only with a mathematical version of the particle theory. And if theory was to be transferred to the physical world, as he intended, the same particles, physically interpreted, would be required. In the case of gravity the only qualities of bodies to which attention needed to be given were their mass and motion, which were also the generally accepted properties of particles. To both of these qualities mathematical reasoning could be applied, thus

⁶³ Cohen and Schofield, pp. 118-119.

⁶⁴ *Principia*, Bk. I, Sect. XI, Scholium, p. 192. In a discussion of gravity he notes concerning the relation between particles and gravity that "it [gravity] must proceed from a cause that penetrates to the very centers of the sun and planets, without suffering the least diminution of its force; that operates not according to the quantity of the surfaces of the particles upon which it acts ... but according to the quantity of the solid matter which they contain ... Gravitation toward the sun is made up out of the gravitations towards the several particles of which the body of the sun is composed ..." *Ibid.*, General Scholium, p. 456.

facilitating the transfer of the conclusions of rational dynamics to the real world.⁶⁵

Newton also hoped to apply the same kind of reasoning to phenomena other than gravitation, "for I am induced by many reasons to suspect that they [the phenomena] may all depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled towards one another, and cohere in regular figures, or are repelled and recede from one another."⁶⁶ Since, however, forces other than quantity of matter seemed to Newton not to be mathematically determinable, no adequate mathematical account of the other phenomena seemed possible, and "These forces being unknown, philosophers have hitherto attempted the search of Nature in vain."⁶⁷ The other forces to which reference is made are those unknown ones which cause electrical and magnetic effects, fermentation, and other chemical reactions, all of which seem to require knowledge of more than simply the mass and motion of the particles of which bodies are made.⁶⁸

Newton's account of the particles, which occurs in the "Rules of Reasoning in Philosophy" and in the Queries appended to the *Opticks*, is that they are solid bits of matter which when compounded form the bodies known in experience. When God created the world he "form'd Matter in solid, massy, hard, impenetrable, moveable Particles, of such Sizes and Figures, and with such other Properties ... as most conduced to the End for which he form'd them."⁶⁹ When the question is raised as to what can really be known of these atomic particles, not much information is offered, although some hints are given in the "Rules of Reasoning in Philosophy." He there points out that one is not "to recede from the analogy of Nature, which is wont to be simple,

⁶⁵ J. H. Randall, Jr., "Newton's Natural Philosophy: Its Problems and Consequences," in *Philosophical Essays in Honor of Edgar Arthur Singer, Jr.*, ed. F. P. Clarke and M. C. Nahm (Philadelphia, 1942), notes that Newton's procedure led to a perplexity which remains unresolved in his own philosophy and in that of his friend John Locke: "What his procedure led him to assume as mathematical postulates [the particles] his empiricism made him treat as real physical existents, at least potentially observable. So he was led to describe the real world as consisting of entities with properties which by definition ought to be observable, yet in fact were not; at the same time that he insisted that sense observation alone furnished the data and the validation of the science of the relations of these entities" (p. 350). "Starting with a subject matter directly experienced, he was led to seek by a dialectic its necessary conditions. He found them in a realm which his own method of verification, the direct appeal to sense, could not possibly reach" (p. 352).

⁶⁶ *Principia*, Preface to the first edition, p. XVIII.

⁶⁷ *Ibid.*

⁶⁸ See in this regard the *Opticks*, Queries 21, 22, and 31.

⁶⁹ *Ibid.*, Query 31. p. 400.

and always consonant to itself,"⁷⁰ that is, that nature is uniform. The qualities of the bodies met in experience are known only by sensation. Hardness, impenetrability, extension, mobility, and inertia are the characteristics so known. Since nature is uniform throughout one can infer, says Newton, that these same qualities are properties of the corpuscles of which macroscopic bodies are composed. But since such qualities as are experienced are not the real, primary, or only qualities possessed by things, but only their secondary ones, the real natures of such particles which are to be inferred from sensible bodies are not known. He also conjectures concerning the powers in nature which produce the various effects observed – the cohesion of bodies, their hardness, elasticity, chemical changes, gravitation towards one another and so forth. He proposes that there may actually be such a force as gravity, and such other forces as cause fermentation, magnetic effects, and chemical reactions. More generally, the particles may be endowed with attractive and repulsive powers which cause all the known characteristics of bodies. But precisely what these other forces are Newton does not clearly indicate; indeed, he admits they are occult.⁷¹ But whatever they are, the point of primary importance for our consideration is that Newton finds himself unable to give a complete account of the nature of reality. In terms of a distinction which Locke was to apply specifically to the mind and its operations, a descriptive account of what occurs is possible but an explanatory account of what occurs is not.

Newton's views concerning what can be known are applied by him to religion as well as to science. One of the features of the movement we have been tracing concerns the close relation between evidence for religious and for scientific propositions. The point was often made that the canons of evidence which hold for one also hold for the other. In Chillingworth reference to scientific knowledge occurred only incidentally, but in Boyle such reference was of fundamental importance. In Newton's writings the relation between religion and science also plays a significant role. Indeed, for him the pursuit of scientific truth has as one of its ultimate justifications insight into religious truth. The first of his letters to Richard Bentley begins: "When I wrote my

⁷⁰ *Principia*, Bk. III, Rule III, pp. 398–399. There is an anomaly in Newton's view as expressed in this Rule, for in terms of knowledge the order is first that one learns by experience the characteristics of large bodies and from them infers those of the minute ones, but in the order of nature the qualities of the large bodies depend on those of the particles.

⁷¹ *Opticks*, Query 31, p. 401. In saying that the causes are occult Newton does not mean to say they are undiscoverable, but only undiscovered to date.

Treatise about our System, I had an Eye upon such Principles as might work with considering Men, for the belief of a Deity, and nothing can rejoice me more than to find it useful for that Purpose.”⁷² In the same letter, and elsewhere,⁷³ he points out that given the complex structure of the solar system – the motion of the planets in the same plane and in the same direction, the exact proportion between the velocity of a planet and its distance from the sun, and so on – such complexity could not be accounted for by material causes alone but only by reference to a deity with mathematical ingenuity. Even the inclination of the earth’s axis, if one is willing to accept an argument from final cause, can be used as evidence for God’s existence. In a manuscript he appeals to instances of design on the biological level and points out particularly the common example of the unique structure of the eye as convincing evidence of the existence of God.⁷⁴

This general view of the close relation between religion and science is also made in the *Principia*, particularly in the section of the General Scholium written in reply to Leibnitz’s criticism that his account of natural philosophy left no place for God and made an appeal to occult causes. Newton, through Roger Cotes’s prompting, took up the challenge and added some thoughts about God in the General Scholium added to the 1713 edition. The interesting part of the reply is his concluding statement about the inclusion of his comments about God in a scientific work: “And thus much concerning God, to discourse of whom from the appearances of things, does certainly belong to Natural Philosophy.”⁷⁵ The interesting phrase here is not so much the last one, that discourse about God has a place in natural philosophy, but the suggestion that such discourse, i.e., one’s ideas of God, are based upon the appearances of things. This suggests a parallel between science and religion, that the evidence for each is of the same kind and is in fact the same, namely the appearances of things. The kind of evidence being the same, the results of inquiry can be expected to be alike too, and this Newton asserts; in his account of the knowledge of both God and nature he points out that only the attributes and not the real natures are known: “We have ideas of His [God’s] attributes, but what the real substance of anything is we know not. In bodies we see only their

⁷² Cohen and Schofield, p. 280.

⁷³ See for example the second and fourth letters to Bentley, Cohen and Schofield, pp. 297–298 and 310–311.

⁷⁴ The manuscript is transcribed in H. S. Thayer, *Newton’s Philosophy of Nature Selections from his Writing* (New York, 1953), pp. 65–66.

⁷⁵ *Principia*, General Scholium, p. 546.

figures and colors, we hear only the sounds, we touch only their outward surfaces, we smell only the smells and taste the savors, but their inward substances are not to be known either by our senses or by any reflex act of our minds; much less, then, have we any idea of the substance of ... God." ⁷⁶

Another feature of Newton's philosophy of science in which his views parallel those of the Royal Society group under consideration, is his account of the relation between mind and nature. As Glanvill and Boyle, for example, had stated that there is no guarantee that what is proved true in human science will prove true in the science of spirits, since their principles may be other (and truer) than man's, so too Newton acknowledges the relation between mind and nature to be a tenuous one. There is no guarantee that what the scientist discovers and considers true of nature really is so. This he makes clear in a letter to Bentley who had presumed that there is a one to one correlation between mind and nature; he writes: "Neither do you prove, that what Men mean by an infinite Sum or Number, is a Contradiction in Nature ... Those things which Men understand by improper and contradictory Phrases, may be sometimes in Nature without any Contradiction at all." ⁷⁷

A final feature of the theory of knowledge of the Royal Society group which finds its way into Newton's views is that a distinction is made between the several degrees of certainty that can be had of a given subject matter. Conclusions in science, as expressly maintained by Boyle, for example, are at best only morally certain, never absolutely or demonstratively so. The same kind of view occurs in Newton, particularly in his account of scientific method. In their controversy concerning the theory of light Hooke had argued that Newton's conclusions could not be demonstratively, but only physically certain. This Newton acknowledged, pointing out that the certainty of the conclusions of a science cannot exceed that of the principles upon which it is based, and adding: "Now the evidence by which I asserted the propositions about colors is in the next words expressed to be from experiments, and so but physical, whence the propositions themselves can be esteemed no more than physical principles of a science." ⁷⁸

An examination of some of Newton's remarks on scientific method will clarify his views on certainty. Unfortunately these remarks are

⁷⁶ *Ibid.*

⁷⁷ Third letter to Bentley dated 23 February 1692/3, Cohen and Schofield, p. 304.

⁷⁸ From a letter to Henry Oldenberg dated 11 July 1672, quoted in H. S. Thayer, p. 81.

brief; there are only a few lines in the Preface to the *Principia* and in the Queries to the *Opticks*.⁷⁹ In the former he states that "the whole burden of philosophy seems to consist in this – from the phenomena of motions to investigate the forces of nature, and then from these forces to demonstrate the other phenomena."⁸⁰ In Query 31, added to the second edition of the *Opticks*, he is somewhat more explicit:

As in Mathematics, so in Natural Philosophy, the Investigation of difficult Things by the Method of Analysis, ought ever to precede the Method of Composition. This Analysis consists in making Experiments and Observations, and in drawing general Conclusions from them by Induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiment, or other certain Truths ... And the Synthesis [composition] consists in assuming the Causes discover'd and establish'd as Principles, and by them explaining the Phenomena proceeding from them, and proving the Explanations.⁸¹

One begins by experiment to discover the forces in nature which produce the phenomena observed. Since in both the *Principia* and the *Opticks* Newton is attempting to present a mathematical account, the phenomena with which he is concerned are such as involve some kind of measurement, for example, the elliptical paths of planets around the sun and the amount of refraction a ray of light undergoes when passing from one medium to another. These measurements, the data, are then so organized as to express a ratio or proportionality, and are universalized by induction into a general conclusion. Being based upon experience, such conclusions are the physical basis of a science and admit of exceptions on only two grounds (mentioned earlier by Boyle too), either that there are experiments yielding contrary results or that the experimental results contradict other truths already accepted. If exceptions do occur then the generalized statement must be so qualified. Being liable to such exceptions, inductive conclusions cannot count as demonstrations and are not to be taken as absolutely true. Nonetheless experiment and observation are "the best way of arguing which the Nature of Things admits of."⁸²

Having discovered empirical regularities which are mathematically expressible one can proceed, by the method of synthesis, to demonstrate

⁷⁹ For more detailed accounts of Newton's views on method see E. A. Burtt, *The Metaphysical Foundations of Modern Physical Science*, especially the first section of Chapter VII; Edward W. Strong, "Newton's 'Mathematical Way,'" *The Journal of the History of Ideas*, XII (1951), 90–110; and J. H. Randall's essay referred to in a previous footnote.

⁸⁰ *Principia*, Preface to the first edition, pp. XVII–XVIII.

⁸¹ *Opticks*, Query 31, pp. 404–405.

⁸² *Ibid.*, p. 404; see also his comment to Cotes that induction is the highest evidence a proposition can have, quoted in Cohen, *Franklin and Newton*, p. 136.

the other phenomena. The statements inductively established are taken as axioms or principles in a deductive system and from them, together with other accepted mathematical principles, one deduces other phenomena, for example (as in the third book of the *Principia*) the motions of the planets, the comets, and the tides. The last phase of the method consists in verifying the predicted results, a matter again of experiment and observation. The method thus depends for its initial data and final verification upon experience.

When the question is raised concerning the certainty the method will yield, the answer seems to be, negatively, that it is less than what his predecessors we have examined called mathematical or demonstrative certainty. In his *Metaphysical Foundations of Modern Physical Science*, E. A. Burtt concludes his discussion of Newton's method with the statement, italicized for emphasis, that science "*thus becomes a body of absolutely certain truth about the doings of the physical world.*"⁸³ This conclusion is stronger than the case admits. It is true that mathematics and demonstration play a significant role in Newton's method of discovering truth in the sciences, and that he has as an ideal the discovery of a few major principles from which all the phenomena of nature can be deduced. However, the mere fact that empirical statements are mathematized and that demonstration occurs do not make the conclusions of a science as certain as mathematics itself. Since the principles which are the basis for the deductions are only inductive generalizations, and not demonstrations, the conclusions can have no greater certainty than the principles themselves, as Newton explicitly acknowledges in his reply to Hooke quoted at the beginning of our discussion of method.

Unlike Newton, his predecessors and contemporaries in the Royal Society had delineated with care several levels of certainty, each corresponding to a particular kind of evidence. At the summit was usually either the certainty of immediate sense perception or that of the axioms of mathematics or metaphysics. Next was the certainty of mathematical demonstrations, followed by the several degrees of morally certain propositions, which class usually contained those of science and religion. At the bottom was mere probability. Newton is much less explicit in his presentation, distinguishing only mathematical propositions from the physical ones of empirical science, and pointing out that scientific statements are not mathematically certain. He admits that conclusions in the sciences may follow deductively from

⁸³ Burtt, p. 223.

premises, but if the premises are only inductive generalizations the conclusions can have no greater certainty. Corresponding to the level of moral certainty there is in Newton's philosophy of science the certainty of the Queries and Scholia scattered throughout his writings. In the main body of each of the primary works only the empirically verified conclusions are presented as real scientific truth, but in the Queries to the *Opticks*, the Scholia scattered throughout his works, and his personal letters, ideas are presented which he regards as highly probable. Cohen points out that the Queries are expressed in the form of rhetorical questions, indicating that the writer accepted as true the ideas presented in them, but was unwilling to assert them categorically for want of sufficient evidence. Thus in Newton, although in very brief and sketchy form, is found the doctrine of the several levels of certainty developed at great length by earlier members of the Royal Society.

Newton's views on the certainty of scientific knowledge, briefly stated as they are, seem then to be similar to those of Wilkins, Glanvill, and Boyle. Although he does not develop extensively the skeptical arguments they do, he nonetheless agrees with them that the real structure of nature is unknown and thus far beyond the reach of science. What the scientist regards as true may in fact turn out to be false since his conclusions are based upon merely human principles. Laws can be discovered which state how events in nature are related, but the ultimate forces, particularly the one causing gravity, as well as the natures of light and physical objects, remain unknown. Science cannot provide an explanatory account of the real structure of nature but must limit itself to a descriptive account of what is observed to occur, and its conclusions are less than absolutely or demonstratively certain. Though his views are not fully developed in his published writings and are stated in a somewhat different terminology than used by Wilkins, Glanvill, and Boyle, they exemplify the spirit of these men, and of his friend John Locke, to whose presentation of the views under consideration we now turn.

CHAPTER V

JOHN LOCKE AND THE PHILOSOPHICAL EXPOSITION OF THE THEORY OF CERTAINTY

In the writings of John Locke (1632–1704), particularly his *An Essay concerning Human Understanding*,¹ a generalized version of the theory of certainty we have been examining finds expression. It occurs not by way of preface to some major work as was often the case in Boyle, nor as a set of statements which almost accidentally find their way into a major scientific treatise as in the case of Newton, but as the major theme of the work itself. His formulation is not specifically intended as a basis for a polemic against Catholicism or atheism as in the writings of Chillingworth and Tillotson, nor as a foundation for natural theology as in the case of Wilkins, nor again as the basis for scientific knowledge as in the cases of Glanvill and Boyle. Though it may have been occasioned by one of these interests, the theory is intended as a descriptive account of what goes on in the mind when knowledge, belief, or error occurs. He describes the difficulties in the way of knowledge caused by the fallibility of the senses, the weakness of the understanding, and the complexity of nature. The exposition of these problems and their solution, based upon an appeal to the certainty of ordinary life and the doctrine of levels of certainty, is the major purpose of the *Essay*. His major conclusion is that the real natures of things are not knowable and that one is therefore limited to a descriptive rather than an explanatory account of what goes on in nature. This result is applied to the very construction of the *Essay* itself, for he writes in the introductory chapter of his intention to use an “historical, plain method,” which is essentially the first step in the Baconian method of science, the accumulation of data and materials into a natural history from which generalizations can be drawn.² It should also be noted that the *Essay* is

¹ John Locke, *An Essay concerning Human Understanding*. The edition used in this chapter is in *The Works of John Locke*, 10 vols. (London, 1812), and will be cited in this chapter as *Essay*.

² Patrick Romanell, in “Locke and Sydenham: A Fragment on Smallpox (1670),” *Bulletin of the History of Medicine*, XXXII (1958), 293–321, attributes Locke’s restriction of

normative in character; Locke wishes to impress on the reader not only the limitations of the mind but also that these limitations ought to be observed. For example, his description of the errors men make in the use of language has as its reverse side the implication that such errors should be avoided. He tries to impress the reader with the necessity of carefully considering his proofs before making a judgment and of proportioning assent to available evidence, and cautions him against prejudice, passion, and indifference in making judgments.

To examine the complex origin of Locke's views would exceed the limits of this study, but a review of some of the pertinent biographical data will show his acquaintance with men whose ideas may have influenced his own thinking.³ The years Locke spent at Oxford as a student, 1652-1658, were within the span of Wilkins' stay there. It is not known whether during those years he was present at any of the meetings in Wilkins' rooms at Wadham College, but some of his teachers were friends of Wilkins. Seth Ward, one of Wilkins' pupils, was his teacher in astronomy, and John Wallis was his teacher in geometry. He also attended lectures in physiology by Thomas Willis (1621-1675) and in medicine by Ralph Bathurst (1620-1704), both of whom were friends of Wilkins and early members of the Royal Society. At this time there also began his life-long friendship with Robert Boyle, in whose rooms at Oxford he met with some of the experimenters. He was elected a Fellow of the Royal Society in 1668; however, his contributions to the group were not outstanding. A year or so before the publication of the *Essay* he made the acquaintance of Newton, with whom he shared an interest in religion and for whom he helped secure a political position. The books of another of his friends, Archbishop Tillotson, were highly praised by him, as was Chillingworth's *Religion of Protestants*, which he thought every gentleman should read to learn the principles of correct reasoning.⁴

In presenting Locke's views our procedure will not be to give an account of them in the exact order and detail of the *Essay* itself, but to select for examination those themes which show the affinities of his

himself to a descriptive account to his medical interests and particularly to his association with Dr. Thomas Sydenham (1624-1689), from whom he learned the clinician's art of describing the symptoms of the patient when the nature of the disease was not clearly understood.

³ Biographical accounts of Locke's life are readily available, e. g., H. R. Fox Bourne, *The Life of John Locke*, and Maurice Cranston, *John Locke: A Biography*, and Richard I. Aaron, *John Locke*, 2nd. ed. (Oxford, 1955). Another account which traces Locke's life in terms of his correspondence and journals is Lord King, *The Life and Letters of John Locke, with extracts from his Journals and Common-Place Books* (London, 1864).

⁴ John Locke, *Some Thoughts concerning Reading and Study for a Gentleman*, Works, III, 271.

views with the perspective of the Royal Society group already studied. The theory about certainty which was previously formulated as the basis for religious and scientific knowledge is now presented in its own right as an account holding for all knowledge. By showing the similarities of his views to those of his predecessors, this part of the *Essay* will appear as the culmination of a fifty year development in English thought and not as the beginning of a new tradition; it will also show his indebtedness to his own countrymen to be as great, or perhaps greater than, his indebtedness to the Cartesian tradition. In particular his account of knowledge and probability, each with its subdivisions, together with the relation of each to science, morality, and religion will be examined.

The introductory chapter of the *Essay* places Locke squarely in the tradition so far examined. He declares his primary purpose is "to enquire into the original, certainty, and extent of human knowledge; together with the grounds and degrees of belief, opinion, and assent."⁵ He points out that, having once discovered the powers and limitations of the mind, one must be both cautious and hesitant concerning what exceeds its powers. He notes, as did his predecessors, that though man's knowledge is limited it nonetheless suffices "for the conveniences of life, and the information of virtue ... it yet secures [men's] great concerns, that they have light enough to lead them to the knowledge of their maker, and the sight of their own duties."⁶ Such discoveries are possible when the understanding is restricted, following Aristotle's principle, to subjects within its scope, "when we entertain all objects in that way and proportion that they are suited to our faculties ... and not peremptorily, or intemperately require demonstration and demand certainty, where probability only is to be had, and which is sufficient to govern all our concerns."⁷ He concludes with the reflection that once the limits of the mind are known, one can, using Locke's phrase, justly acquiesce in his ignorance of what is unknown and employ his thoughts to advantage in what can be known.

Locke's account of knowledge and certainty, particularly as developed in the fourth book of the *Essay*, is quite systematic and orderly in its presentation, though not without its difficulties. He is consciously

⁵ *Essay*, I, i, 2, *Works*, I, 1. For a similar statement see the Journal entry for 6 March 1677, King, p. 106. The entry for this date seems to be an early draft of the introductory chapter of the *Essay*.

⁶ *Essay*, I, i, 5, *Works*, I, 3-4; see also the Journal entry for 8 February 1677, King, pp. 87-91.

⁷ *Essay*, I, i, 5, *Works*, I, 4.

aware of the problem he has set for himself – determining the nature and extent of knowledge – and so attempts to be as precise as possible in his terminology and definitions. Having dealt earlier with the origin of the materials of knowledge, ideas, and with language, he undertakes in Book Four an extended discussion of knowledge – its definition, kinds, limitations, reality, and truth – and presents numerous illustrations of particular and general propositions said to be true or probable.

His approach parallels in many respects the views of such men as Wilkins, Glanvill, and Boyle. The major distinction he makes, as did they, is between knowledge and probability, each of which he defines and subdivides. It should be noted, however, that although the doctrine presented is in its fundamental features identical with that of his predecessors, there are terminological differences. They had generally distinguished mathematical or metaphysical certainty from moral certainty, and this again from mere probability. In Locke, ‘certainty’ applies only to what is known to be true and thus corresponds to the metaphysical and mathematical certainty of his predecessors. In his account one assents to or believes with the appropriate degree of firmness what is judged but not known to be true, i.e., what is probable, and this corresponds to what they regarded as being morally certain and probable. Locke does not use the phrase ‘moral certainty’ which had carried so much meaning since Chillingworth made it common. He thus restricts the application of the term ‘certainty’ in a way his predecessors did not.⁸

After defining knowledge as the perception of the agreement or disagreement of ideas, Locke tries to classify the several kinds of agreement or disagreement discoverable among them. The perception is of the relation of ideas – identity, diversity, co-existence and necessary connection – or of their real existence, i.e., that the object of an idea really exists. Strictly speaking, real existence (except in one case, God) is not discovered by perceiving an agreement or disagreement among

⁸ In a reply to Edward Stillingfleet, Bishop of Worcester, Locke makes explicit his restriction of the term “certainty.” He writes: “For, with me, to know and to be certain, is the same thing; what I know, that I am certain of; and what I am certain of, that I know. What reaches to knowledge, I think may be called certainty; and what comes short of certainty, I think cannot be called knowledge ... Faith stands by itself, and upon grounds of its own; nor can be removed from them, and placed on those of knowledge. Their grounds are so far from being the same, or having any thing common, that when it is brought to certainty, faith is destroyed; it is knowledge then, and faith no longer.” This statement is from Locke’s second letter to the Bishop of Worcester and quoted in a lengthy footnote by the editors of the *Works* (II, 292–293). Locke’s restriction of knowledge to the two categories of intuition and demonstration was in all likelihood derived from Descartes’ *Rules for the Direction of the Mind*, Rules II and III in the *Philosophical Works of Descartes*, I, 2–8.

ideas, and so will be separately considered. Three kinds of knowledge – intuition, demonstration, and sensitive knowledge – are distinguished, each with its corresponding level of certainty. The first kind depends upon the direct perception of the connection of ideas, and yields the greatest certainty possible:

For in this [intuition] the mind is at no pains of proving or examining, but perceives the truth, as the eye doth light, only by being directed towards it. Thus the mind perceives, that white is not black, that a circle is not a triangle, that three are more than two, and equal to one and two. Such kind of truths the mind perceives at the first sight of the ideas together, by bare intuition, without the intervention of any other idea; and this kind of knowledge is the clearest and most certain, that human frailty is capable of. This part of knowledge is irresistible, and like bright sun-shine forces itself immediately to be perceived, as soon as ever the mind turns its view that way; and leaves no room for hesitation, doubt, or examination, but the mind is presently filled with the clear light of it. It is on this intuition that depends all the certainty and evidence of all our knowledge.⁹

It is interesting to note that in his description of intuitive knowledge Locke employs a simile used earlier by Descartes and Boyle, that the mind sees truth as the eye sees its object, directly; as there is no appeal beyond what is immediately seen, so the mind sees its object – the connection between ideas – immediately.¹⁰ This kind of mental perception, it should be further noted, is irresistible once one is acquainted

⁹ *Essay*, IV, ii, 1, *Works*, II, 297–298; see also *Essay*, IV, vii, 4, *Works*, III, 20–23 for a reaffirmation of the point. The view about the certainty of knowledge expressed here was one Locke had from the very beginning. In the first 1671 draft of the *Essay* he speaks quite often of knowledge as being infallible. He writes, for example: “*That a man hath an infallible certain knowledg of universal Identical [sic] affirmative propositions and others depending there upon, v.g. that what is is The reason ... of the evidence of those universall propositions is noe thing else but the cleare and distinct knowledg that every man hath of his own Ideas where by he most evidently and perfectly knows every one by its self and distinguishes it from others ... and that two distinct Ideas when they are there are not one and the same Idea soe that all such affirmations and negations are made without any manner of doubt uncertainty or hesitation, as the clearest knowledg we can have ...*” (*An Early Draft of Locke’s Essay Together with Excerpts from his Journals*, eds. R. I. Aaron and Jocelyn Gibb (Oxford, 1936), pp. 41–42, brackets theirs). Since this early draft is generally known as *Draft A* reference to this volume will be by that name unless citations are from the *Journals*.

¹⁰ In his *John Locke* (p. 220) Aaron notes that the doctrine of intuition as formulated in the opening sections of Book Four of the *Essay* does not have its counterpart in *Draft A*, and theorizes that it is the product of Locke’s encounter with Cartesianism while in France in the late 1670’s. It is true that the notion of intuition and the language of the mind’s perceiving the agreement or disagreement of its ideas do not occur in the early draft, but everything else relevant to the doctrine does appear – the mind’s having ideas which are seen to be distinct from one another, the comparison of the mind to the eye, the irresistibility of the recognition that certain propositions are true, and the claim to infallibility (*Draft A*, pp. 53–54). The major difference between *Draft A* and the *Essay* on this point lies in the better organization of the latter and the incorporation of “intuition” as a general term covering the mind’s immediate perception of the relations between certain of its ideas. It is also worth noting that such a concept as the irresistibility of the highest kind of knowledge is as old among English writers as Chillingworth. The comparison of the mind to the eye appears in Boyle’s writings also, although it probably had its source for both men in Descartes’ *Rules for the Direction of the Mind* and *The Principles of Philosophy*.

with the ideas; one cannot help but assent when he notes that two ideas are or are not related in a particular way. Thus Locke claims for intuitive knowledge what Chillingworth and Wilkins, for example, claimed for the highest kind of knowledge of which man is capable, namely, that it is irresistible and that assent is forced. It is such as to leave "no room for hesitation, doubt, or examination." He points out that the certainty of intuitive knowledge is the greatest that one could ever have or even imagine, adding that "He that demands a greater certainty than this, demands he knows not what, and shows only that he has a mind to be a sceptick, without being able to do so."¹¹

The certainty claimed for such intuitively known propositions is infallible certainty. However, the infallibility Locke claims can at best be what his predecessors called conditional rather than absolute infallibility, for there are factors which might make even identical propositions false. Such knowledge is subject to error if conformity between language and thought is absent: "... if our notions be wrong, loose, and unsteady, and we resign up our thoughts to the sound of words, rather than fix them on settled determined ideas of things; I say these general maxims will serve to confirm us in mistakes; and in such a way of use of words, which is most common, will serve to prove contradictions."¹² If one thinks an idea to be clear when it is not or if one attends to the language of a proposition rather than to the ideas for which the words stand, one's intuitive perception may be faulty. Since such errors can occur, there is no guarantee, ultimately, of the truth of an intuitive proposition. Generally, however, Locke is unwilling to admit that error occurs in intuition. When faced with the fact that people in error are as certain of their beliefs as those who see the truth correctly, Locke's reply seems to be that intuitive certainty is not simply a matter of a feeling of security in one's claim to knowledge. Over and again he repeats the phrase that it is not the strength of one's private persuasions which gives any thing the stamp of truth since men in error are as convinced of their beliefs as anyone else.¹³ The perception whereby intuition occurs is a mental act akin to sense perception, and as one cannot help but see the sun when his eyes are turned toward it, so one cannot but see the connection between ideas. In short, for Locke

¹¹ *Essay*, IV, ii, 1, *Works*, II, 298.

¹² *Ibid.*, IV, vii, 12, *Works*, III, 31. Earlier in the *Essay* Locke had written about error in intuition that "if there even happen any doubt about it, it will always be found to be about the names, and not the ideas themselves, whose identity and diversity will always be perceived, as soon and clearly as the ideas themselves are; nor can it possibly be otherwise" (*Essay*, IV, i, 4, *Works*, II, 290).

¹³ *Ibid.*, IV, xix, 9-16, *Works*, III, 138-145.

as for Boyle, the mind's perception of the agreement or disagreement of ideas is the court of last appeal and is the source of infallible certainty.¹⁴

Propositions known intuitively are for the most part analytic, what Locke called trifling propositions or maxims. Some intuitive propositions are singular, some are general, some merely verbal, and most are about the relations of ideas. Propositions stating identities or diversities are, says Locke, as numerous as one's ideas but are of little value in the sciences. Those stating mathematical relations are also numerous and are more useful. There are very few intuitively known propositions of necessarily co-existent ideas; Locke mentions only one or two. Only one instance is given of an intuitively known existential proposition and it is the non-tautological one, "I exist." Between the two terms or ideas "I" and "exist" there seems to be no perceived relation as there is between "whole" and "part" in "the whole is greater than the part." However Locke claims for "I exist" that it is intuitively true. The intuition seems to be of a somewhat different order for, following Descartes, it is from the fact that conscious experience occurs that one knows he exists: "For I know if I feel pain, it is as evident I have as certain perception of my own existence, as of the pain I feel: or if I know I doubt, I have as certain perception of the thing doubting, as of that which I call doubt."¹⁵ The difference in the kind of intuition – the certainty seems to remain the same – arises from the fact that the propositions are of different kinds, the one being general knowledge depending wholly upon necessary relations of universal ideas, non-existential, and usually non-instructive; the other concerned with particular existents, knowledge of which is not expressible in universal propositions.¹⁶

¹⁴ Locke's formulation of the criterion problem resembles Boyle's; he points out that to demand a criterion for the criterion would lead to an infinite regress. Writing of the truth of trifling propositions he points out: "He that cannot discern the truth or falsehood of such propositions, without the help of these and the like maxims [laws of identity and non-contradiction], will not be helped by these maxims to do it; since he cannot be supposed to know the truth of these maxims themselves without proof, if he cannot know the truth of others without proof, which are as self-evident as these. Upon this ground it is, that intuitive knowledge neither requires nor admits any proof, one part of it more than another. He that will suppose it does, takes away the foundation of all knowledge and certainty: and he that needs any proof to make him certain, and give his assent to this proposition, that two are equal to two, will also have need of a proof to make him admit, that what is, is" (*Essay*, IV, vii, 19, *Works*, III, 38–39). See also in this connection *Essay*, IV, xvii, 14, *Works*, III, 120.

¹⁵ *Ibid.*, IV, xi, 3, *Works*, III, 63. *Draft A* shows Locke's dependence on Descartes with respect to knowledge of the existence of self more than does the *Essay*. Having written of the testimony of the senses for the existence of material objects he points out that such certainty is "as great as human nature is capable of concerning the existence of anything but a mans self alone, this being according to Des Cartes to every one past doubt that whilst he writes or thinks that he writes, he that thinks, doth exist" (*Draft A*, p. 20).

¹⁶ This distinction, which is made in the *Essay* (IV, ix, 1, *Works*, III, 49), had already been implicitly made in *Draft A* (pp. 42–44 and 46–48).

The second kind of knowledge is demonstration, the perception of the agreement of ideas by the perception of their mutual relation to another idea or set of ideas. Demonstration is required when the mind cannot immediately see a connection between two of its ideas and there is some question whether such a relation exists. Though a demonstration consists of several steps, each of which depends upon intuition and memory, it nevertheless classifies as knowledge. But since each step must be carried in the fallible memory for the duration of the proof, there is a decrease in the clarity and assurance that the two initial ideas really are related. A demonstration, in short, is liable to error in a way that intuition is not and therefore is less certain than intuitive knowledge. One note of interest is that Locke does not limit demonstration to mathematics and logic. Whatever the subject matter, so long as the ideas involved are clear and determinate, demonstration is possible. In particular, the existence of God is demonstrable and so too, he proposes, are the principles of ethics.

The kinds of knowledge so far considered, intuition and demonstration, are the only ones that yield general propositions that are certain and classify as knowledge. Considering Locke's distinction between real and nominal essence as the distinction between the real structure of a thing on which its known properties depend and the idea or set of ideas one takes a name to stand for, true general propositions involving either simple or complex ideas, in which real and nominal essence coincide, are discoverable but are mostly uninformative. General statements about the nominal essences of substances are difficult to secure since nominal essences are "such combinations of simple [ideas], as carry not with them any discoverable connexion or repugnancy but with a very few other ideas."¹⁷ The case for true propositions about the real essences of substances is in even more dire straits for two reasons: first, the real natures of substances on which observable qualities depend are not known, and second, even if they were, no connection could be discovered between any secondary quality and a primary one. The conclusion to be drawn from this is that for Locke there can be no science of nature – no set of statements intuitively or demonstratively true of nature.

To come to this conclusion, however, is not to say that nothing can be known or that one cannot be certain about the existence of the external world, for there is another degree of knowledge which, though lower in certainty than either intuition or demonstration, is higher in

¹⁷ *Essay*, IV, vi, 6, *Works*, III, 10.

certainty than probability. This is sensitive knowledge. The evidence which puts the existence of physical objects beyond doubt is, first, the difference between ideas of which the mind is the cause and those which seem to be imposed on it from without, and second, that pleasures and pains can be produced only by real bodies and not by imaginary ones. Sensitive knowledge differs from the higher degrees of knowledge in that the bare having and comparing of ideas is no guarantee whatever of the existence of the things in question. Knowledge of external things is based on the reception of ideas from without, ideas of which one is not himself the cause, and not on the perception of agreement or disagreement of ideas irrespective of their origin.¹⁸ The fact that the causal factors operating in the production of sense impressions are not known does not derogate, says Locke, from one's certainty that what he sees really is a physical object, e.g., the paper on which he is writing:

And of this, the greatest assurance I can possibly have, and to which my faculties can attain, is the testimony of my eyes, which are the proper and sole judges of this thing, whose testimony I have reason to rely on as so certain, that I can no more doubt, whilst I write this, that I see white and black, and that something really exists, that causes that sensation in me, than that I write or move my hand; which is a certainty as great as human nature is capable of, concerning the existence of any thing, but a man's self alone, and of God.¹⁹

Sensitive knowledge guarantees that external physical things exist, but gives no knowledge of what they are. Thus as Locke describes man's knowledge, whether intuitive, demonstrative, or sensitive, a basic skepticism appears for the real natures of both spiritual and physical things remain beyond comprehension.²⁰

¹⁸ Stillfleet objects to Locke's account of sensitive knowledge that it does not agree with his earlier definition of knowledge and that therefore Locke cannot claim to have genuine knowledge of the existence of physical objects. In his *Second Letter* Locke replies: "Now the two ideas, that in this case are perceived to agree, and do thereby produce knowledge, are the idea of actual sensation (which is an action whereof I have a clear and distinct idea) and the idea of actual existence of something without me that causes that sensation. And what other certainty your lordship has by your senses of the existing of any thing without you, but the perceived connexion of these two ideas, I would gladly know" (*Works*, IV, 360). This reply seems to be a rather weak *ad hoc* solution to the objection. I am indebted to Harry M. Bracken for pointing out this passage in the *Second Letter*.

¹⁹ *Essay*, IV, xi, 2, *Works*, III, 63. A very similar statement appears in *Draft A*, p. 20, but differs from the one quoted by emphasizing that sensitive knowledge is wholly adequate for the practical activities of life.

²⁰ The skeptical view is already present in *Draft A* of the *Essay*, pp. 3, 5, 16, 20, 46, and 55. An even earlier statement of this skeptical view can be found in several lines of the Smallpox Fragment of 1670 which is the basis for Romanell's article cited above; Locke writes: "But tis but ostentation & losse of time to lay down hypothesis [hypotheses] wch are many times false always uncertain & make a show to enquire into the essences of things & pretend to shew the way & manner of their observacon things that we cannot know being beyond the information of our senses or the reach of our understanding & therefor with very little advantage pretend to them" (p. 295; brackets are Romanell's).

The assurance that sensitive knowledge is in its way certain depends upon the condition, which had also played a significant role in the views of his predecessors, that "our faculties act and inform us right, concerning the existence of those objects that affect them."²¹ Having made this assumption there is no justifiable doubt of their existence; God gives an assurance that the faculties are working correctly through the attachment of pleasures and pains to certain sensations. To this assumption, which gives the initial and greatest assurance that the senses do not deceive, Locke adds in the same chapter several other considerations in favor of their reliability: first, since persons without normal sensory equipment do not have certain ideas, one can be sure such ideas come only through the senses; second, since sense impressions are often produced contrary to the will, they can only come from some external source, a physical object; third, the senses confirm each other's reports; and finally, the reactions of other persons in a given situation are similar to one's own. With anyone who refuses to trust his senses under such conditions Locke simply refuses to speak. Skepticism is simply impractical.²²

Though Locke claims for sensitive knowledge a certainty only a little lower than demonstrative certainty, he recognizes its inherent limitations. In the first place one can be sure only at the moment he sees an object that it exists; there is no sensitive knowledge of past or future existents or of those out of the range – both distance and size – of the senses. It may well be probable that they exist, but this probability can never amount to the certainty of sensitive knowledge since there is no necessary connection of one moment with another. This is not to say that one should doubt their existence when they are not being seen for, though limited to what is presently perceived, sensitive knowledge can be stored in memory. However, such recollection can never be counted for knowledge; one's assurance is "but probability, not knowledge."

In his discussion of sensitive knowledge Locke points out, a remark applicable to all the levels of knowledge and probability, that to expect more certainty than the evidence in the case admits, and in particular to demand demonstration where it is not available, is vain. Writing in

²¹ *Essay*, IV, xi, 3, *Works*, III, 63.

²² Locke is quite emphatic in his refusal to submit to the arguments of the skeptics; their view is impractical and they are not to be reasoned with: "... for I think nobody can, in earnest, be so sceptical, as to be uncertain of the existence of those things which he sees and feels. At least, he that can doubt so far (whatever he may have with his own thoughts) will never have any controversy with me; since he can never be sure I say any thing contrary to his own opinion" (*Essay*, IV, xi, 3, *Works*, III, 63–64).

the spirit of the tradition of his predecessors, he makes the further point that the mere possibility that something is false is not a sufficient ground for doubting its truth. From the fact that something cannot be proved demonstratively, it does not follow that one must come to an uncertain conclusion, but only that he must proportion his belief to the evidence. Although the possibility of error is ever present one must live as though it will never become an actuality; to do otherwise would be disastrous. Ordinary, unreflective people are not affected by such possibilities, consequently their assurance of truth is to be made the standard of truth where demonstration is not attainable. All the ventures of life from eating one's dinner to the handling of political affairs could go awry, but no one acts as though they will. To refuse assent on the possibility of error alone would be fatal: "Whereby yet we may observe, how foolish and vain a thing it is ... to expect demonstration and certainty in things not capable of it ... He that in the ordinary affairs of life would admit of nothing but direct plain demonstration, would be sure of nothing in this world, but of perishing quickly. The wholesomeness of his meat or drink would not give him reason to venture on it: and I would fain know, what it is he could do upon such grounds, as are capable of no doubt, no objection."²³

For the extreme skeptic who takes refuge in the dream hypothesis, Locke has an answer too.²⁴ If everything is a dream, then the hypothesis that everything is a dream may itself be a dream event, making it unimportant for the objector to be answered. He adds further that if everything is a dream then arguments are of no value and truth and knowledge are worthless, and that since pleasures and pains follow certain self-instigated experiences (e.g., putting one's hand in a fire), one can be sure that such bodies are real and not simply products of dream experiences. To anyone who persists in being skeptical Locke replies that he admits that absolute certainty is not within reach, but refuses to admit despair since such knowledge as the senses furnish is still of practical value:

I make him [the skeptic] this answer, that the certainty of things existing in *rerum natura*, when we have the testimony of our senses for it, is not only as great as our frame can attain to, but as our condition needs. For our faculties being suited not to the full extent of being, nor to a perfect, clear, comprehensive knowledge of things free from all doubt and scruple; but to the preservation of us, in whom they are; and accommodated to the use of life; they serve to our purpose well enough, if they will but give us certain notice of those things, which are convenient or inconvenient to us.²⁵

²³ *Ibid.*, IV, xi, 10, *Works*, III, 68-69.

²⁴ *Ibid.*, IV, xi, 8, *Works*, III, 67.

²⁵ *Ibid.*, IV, xi, 8, *Works*, III, 67. It should be noted that Locke's view of the senses as a

Locke acknowledges that the mind's acquisition of truth is very limited and therefore makes a distinction between what is known to be true and what is only judged to be so or is probable. Intuition and demonstration yield no existential knowledge, except of self and of God, and thus can be the basis for neither a scientific understanding of the world nor for the ordinary affairs of common people. Connections are not discoverable between all clear ideas, and not all ideas are so clear that connections could be discovered between them. Rather than saying that one is simply ignorant where knowledge is wanting, Locke discovers a median value, probability, to cover the vast range of items – most of those the mind entertains – which are believed, but are not known in the strict sense of the term. Probability is distinguished from knowledge in that it “is nothing but the appearance of such an agreement or disagreement [of ideas], by the intervention of proofs, whose connection is not constant or immutable, or at least is not perceived to be so, but is, or appears for the most part to be so, and is enough to induce the mind to judge the proposition to be true or false, rather than the contrary.”²⁶

The evidence upon which the degree of probability rests is, generally, twofold: the conformity of the belief in question with previous experience, knowledge, and sensation: and the testimony of other persons.²⁷ Locke is more thorough in his evaluation of testimony than were, for example, Tillotson, Wilkins, and Glanvill, and points to six specific criteria in terms of which it is to be evaluated. The number of witnesses, their integrity, their skill in presenting the evidence, their purpose, the internal consistency of the evidence and its agreement with the circumstances, and lastly, the presence or absence of contrary testimony, are all to be considered. How the criteria are to be applied Locke does not make explicit, pointing out only that as “the number and credibility of testimonies, do more or less agree or disagree with it, so is any proposition in itself more or less probable.”²⁸ In probability as in knowledge there are degrees of both evidence and assent which must be kept in

system for warning us of things which may be beneficial or injurious is one he holds in common with Descartes. In the sixth of his *Meditations* Descartes makes the point that the senses do not yield knowledge of the reality or nature of things but do give warning of what may be harmful to our lives. This view also occurs in *Draft A*, p. 20.

²⁶ *Essay*, IV, xv, 1, *Works*, III, 88.

²⁷ *Ibid.*, IV, xv, 4, *Works*, III, 90; see also *Draft A*, pp. 56–57.

²⁸ *Essay*, IV, xv, 6, *Works*, III, 91. Locke also notes in the same section that probability is sometimes based upon commonly received opinion, than which “there can not be a more dangerous thing to rely on, nor more likely to mislead one; since there is much more falsehood and error among men than truth and knowledge.” See also *Essay*, IV, xx, 17–18, *Works*, III, 157–159 and the *Journal* entry for 17 June 1679, *King*, p. 136.

constant proportion. The assent given should be on the basis of evidence present to the mind. Once a judgment has been made, however, one can retain in memory the fact that at a particular time the evidence was scrutinized, and thus be certain of a proposition even though the evidence no longer exists.

Locke's account of the kinds and levels of probability, worked out as early as the 1671 *Draft A* of the *Essay*, is developed in considerable detail. Two general categories are distinguished: matters of fact and matters of speculation (following the terminology of the *Essay*), the difference between them depending on the availability and value of the evidence. In the first general category he distinguishes probability of things which are always constant, those which are generally constant, and those which are variable. In addition he adds probability of things which are quite indeterminate. He describes the first:

The first therefore, and highest degree of probability, is, when the general consent of all men, in all ages, as far as it can be known, concurs with a man's constant and never failing experience in like cases, to confirm the truth of any particular matter of fact attested by fair witnesses; such are all the stated constitutions and properties of bodies, and the regular proceedings of causes and effects in the ordinary course of nature.²⁹

Simple scientific laws stating regularities in nature are thought by Locke to have this highest degree of probability, for example, that fire produces warmth, that it melts lead, and that it consumes wood, or that iron sinks in water but floats in mercury. Such regularities as these are discovered not only in one's own experience, but in that of all men. From this one is justified in concluding that they are consequences of regular causal forces in nature, though such forces, Locke admits, "come not within the reach of our knowledge."³⁰ Some non-scientific propositions of the same sort are that all Englishmen agree that it froze last winter and that there were swallows last summer. All these statements are of matters of fact which, so far as human experience goes, are universally discoverable and constant whenever observed; because of their uniformity they yield a certainty about equal to that of demonstrative knowledge, and for all practical purposes one's assent to them is as strong. Locke notes: "These probabilities rise so near to a certainty, that they govern our thoughts as absolutely, and influence all our actions as fully, as the most evident demonstration; and in what concerns us, we make little or no difference between them and certain knowledge. Our belief, thus grounded, rises to assurance."³¹

²⁹ *Essay*, IV, xvi, 6, *Works*, III, 96; see also *Draft A*, p. 57.

³⁰ *Ibid.*

³¹ *Ibid.*, IV, xvi, 6, *Works*, III, 96-97; see also *Draft A*, pp. 57-58.

The second level of probability occurs "when I find by my own experience, and the agreement of all others that mention it, a thing to be, for the most part, so; and thus the particular instance of it is attested by many and undoubted witnesses."³² Here the probability is lower than in the first level because the item in question is not always found to be the same in all men's experience, that is, the evidence is not as constant. Locke suggests as instances the psychological statement that all men prefer their private advantage to the public interest, and the historical one that Tiberius preferred his private advantage over the public interest. As a consequence of the absence of complete uniformity in the evidence, the assent is not as firm, "and in this case our assent has a sufficient foundation to raise itself to a degree we may call confidence."³³

The third level of probability is of matters of fact which follow no known sequential patterns but seem to be "things that happen indifferently." Locke mentions such incidents as that it thundered to a person's left rather than to his right, or that a bird flew north rather than east, as well as such geographical and historical ones – the examples are by now familiar – as that Rome is a city in Italy, that Julius Caesar lived seventeen hundred years ago, and that he was a general who fought against Pompey. Such a matter of fact as any of these, says Locke, "though in the nature of the thing there be nothing for nor against it, yet being related by historians of credit, and contradicted by no one writer, a man cannot avoid believing it."³⁴ Assurance of any such matter of fact is called confident belief.

In his account of probability, as so far related, Locke agrees with other Royal Society members in claiming that assent or strength of belief must be proportioned to evidence and that there are levels of probability. In the latter point his position is more developed than theirs in that he tries to differentiate the levels by noting specific differences in the evidence, as in the three cases above. Another significant factor in Locke's position, one which distinguishes his view from his predecessors, concerns the way assent is given in probability. One of the traditionally recognized differences between knowledge and probability, when the words are taken in their strict senses, was that in the former assent was somehow irresistible whereas in the latter it was freely given upon consideration of the evidence. Although Locke

³² *Essay*, IV, xvi, 6, *Works*, III, 97; see also *Draft A*, p. 58.

³³ *Essay*, IV, xvi, 7, *Works*, III, 97; see also *Draft A*, p. 58.

³⁴ *Essay*, IV, xvi, 8, *Works*, III, 97–98; see also *Draft A*, p. 58. In discussing this level of probability in *Draft A* Locke does not use examples as he had for the other levels.

adheres to this distinction with respect to the lowest degrees of probability, he does not do so with respect to the levels already mentioned. In those three cases assent is not freely but necessarily given: "Probability upon such grounds carries so much evidence with it, that it naturally determines the judgment, and leaves us as little liberty to believe or disbelieve, as a demonstration does, whether we will know or be ignorant."³⁵

The point to be noticed here is that a shift has occurred in the theory of assent. Whereas his predecessors had asserted that where there is no reasonable ground for doubt, assent can be freely given in full confidence that the thing is as assented to, Locke's position is the stronger one that where the evidence is sufficient and unquestionable – he does not use the phrase 'reasonable doubt' – assent is forced as in demonstration, and so cannot be given or withheld as one wishes. This distinction between forced and free assent is made the difference between the first three and the fourth levels of probability of matters of fact.

The difficult cases of probability are those of the fourth class in which evidence is not such as to win immediate and complete assent. When one's own experiences contradict common experience, or when witnesses contradict what is believed to be historical fact, one is hard put to make a judgment. Because many variables may enter into a situation, it is impossible to lay down rules for the measuring of either evidence or assent; generally, however, assent must be proportioned to the evidence and is to be given on the side on which the evidence seems to be strongest.³⁶ It is worth noting that Locke applies these comments explicitly to cases of law and implicitly to arguments concerning tradition in religion. In English law, he points out as did Boyle, an attested copy of a record can be used as evidence but a copy of the copy, however well vouched for, is not as good. A direct report by a witness is good proof that a particular event occurred, but a report of his report is not, and will not be admitted in a court of law. The farther from the source, the weaker the evidence becomes. In matters of tradition, religious tradition particularly, the age of a doctrine cannot be taken as evidence for its truth, for, being far from its source, there are no longer any eye-witnesses of the event involved in the belief. To

³⁵ *Essay*, IV, xvi, 9, *Works*, III, 98; see also *Essay*, IV, xx, 16, *Works*, III, 156 and *Draft A*, pp. 66–67. He does note, however, that although assent cannot be withheld once the evidence is considered, one is free to stop examining the evidence; thus freedom is not wholly absent.

³⁶ *Essay*, IV, xvi, 9, *Works*, III, 98; see also *Draft A*, p. 59.

accept a doctrine on such grounds, says Locke, would be to invert the rule of probability that assent should be proportioned to evidence. The practice of giving assent where the evidence is not conclusive, he says, "seems to me utterly impracticable, and as impossible, as it is to believe the same thing probable and improbable at the same time."³⁷ In connection with cases in which the evidence for a proposition does not outweigh the evidence against it, it is worth noting that in a journal entry for 1671 Locke, as did his predecessors, made one major exception, the wager argument.³⁸ From Chillingworth to Boyle some version of this argument was used with respect to such fundamental articles of religion as the existence of God and future rewards; in such crucial cases where the evidence is not great enough to win assent, one is justified in assenting on the ground that failure to do so might have worse consequences in the long run than would assent.

One of the tendencies noted in such writers as Tillotson and Wilkins was the disparity between what Tillotson called the certainty of evidence and the certainty of assent. It was a part of their views that assent should always be proportioned to the evidence and be no stronger than the evidence warranted. However, they admitted that in terms of the feeling of certainty they were sometimes more certain than the evidence warranted. Certainty tended to become a psychological feeling of assurance unrelated directly to evidence. The same tendency also occurs in Locke. In his discussion of error and of fanaticism in religion he inveighs against those who identify certainty with their feeling of assurance, which suggests that as a matter of fact certainty is often only a matter of feeling. But the same holds true in his own account of probability. In it he had noted that one is as certain of the higher degrees of probability as of demonstration; in the face of contradictory evidence one is no more willing to give up what is probable than what is demonstratively true. From a psychological point of view, one is as certain of the one as of the other, although, in his formal account of each, only what is intuitively or demonstratively proved is genuinely known to be true.

Distinct from probabilities of matters of fact are those which Locke calls matters of speculation, which differ from the former in not being based upon direct observation or testimony. Its subject matter includes the existence, nature, and operation of such finite immaterial beings as spirits, angels, and devils; the existence of sub-sensible bodies;

³⁷ *Essay*, IV, xx, 15, *Works*, III, 156.

³⁸ Journal entry for 29 July 1676, *An Early Draft of Locke's Essay*, pp. 81-82.

and life and intelligence on other planets. Also unknown is the manner of operation of the forces of nature; one can only speculate as to how animal life is generated and nourished, how a magnet attracts iron, how the tallow in a candle turns into flame and heat, and so on. Such matters as these cannot be accounted for by observation or experiment, but "can appear more or less probable, only as they more or less agree to truths that are already established in our minds, and as they hold proportion to other parts of our knowledge and observation."³⁹ The evidence available here is argument by analogy; from the fact that two bodies rubbed together vigorously produce heat, using Locke's examples again, one can infer that other instances of heat and flame are caused by the rapid motions of minute particles; noting that differently textured cloths produce different colors, one can infer that the colors of bodies are produced by different arrangements of their minute particles; and so on. This kind of argument, as used by Locke, is the same as Newton had used the *Principia*, where, in the third of the "Rules of Reasoning in Philosophy," he had stated that, assuming the uniformity of nature, one can infer that bodies not within the range of experience have the same qualities as those within it.

Earlier in the *Essay* Locke had discussed the idea of substance and had tried to show that the natures of both individual substances and of substance *per se* are highly speculative. Knowledge of a physical object is based upon sense perception but what is so known is only that it exists, not what it is. The real nature of a body lies beyond knowledge. All the mind can know about it is its experienced qualities and these, which come in groups, the mind joins as its nominal essence. One finds in experience that certain ideas are conjoined, but no necessary connections are found among them, nor between each of these qualities and the body itself, nor is there any way of knowing whether they will be conjoined in any other body. Experiments are of no great help for they do not extend one's understanding beyond what is probable. The mind, however, not content simply to attend to collections of such ideas, "supposes" some of them to belong to the thing itself: "not imagining how these simple ideas can subsist by themselves, we accustom ourselves to suppose some substance wherein they do subsist, and from which they do result, which therefore we call substance."⁴⁰

³⁹ *Essay*, IV, xvi, 12, *Works*, III, 101; see also *Draft A*, p. 59.

⁴⁰ *Essay*, II, xxiii, 1, *Works*, II, 1. In a succeeding paragraph Locke notes that the complex idea of a given substance is a composite of several distinct simple ideas to which is annexed the not too clear notion of a something in which these ideas (i. e., the qualities of which they are the ideas) inhere. The latter notion not being clear, it follows that on the account of

The idea of substance as a metaphysical support for observed qualities Locke finds no more meaningful than substance as the set of primary qualities of an object. One can give it no more meaning than that it is the support of observed qualities; one "will find he has no other idea of it at all, but only a supposition of he knows not what support of such qualities, which are capable of producing simple ideas in us; which qualities are commonly called accidents."⁴¹

Two consequences follow from the inability to know the nature of substance with intuitive or demonstrative certainty. The first is the general one that metaphysics, insofar as it pretends to certain knowledge of the essence of things, becomes an impossibility. Thus in Locke's writings one finds a telling blow dealt in English thought to the dearest of philosophy's enterprises, a blow arising from a descriptive account of the limitations of the human mind. Second, and more specifically for Locke, a science of nature – the ideal for Locke as for Glanvill is that science or natural philosophy is a demonstrative system – is no longer possible. He concludes: "This way of getting and improving our knowledge in substances only by experiences and history, which is all that the weakness of our faculties in this state of mediocrity, which we are in in this world, can attain to; makes me suspect, that natural philosophy is not capable of being made a science."⁴²

Locke does not therefore despair concerning man's understanding of nature. Indeed, he finds two grounds for consolation. The first is that although science as a demonstrative system is not possible, laws of nature and conclusions in the natural sciences as probabilities are

knowledge in Book Four no certain knowledge can be had of substance. See in this connection *Essay*, II, xxiii, 3, *Works*, II, 5–7; *Essay*, II, xxiii, 5, *Works*, II, 9–11; and *Draft A*, pp. 3–5.

⁴¹ *Essay*, II, xxiii, 2, *Works*, II, 2. Locke adds immediately: "The idea then we have, to which we give the general name substance, being nothing but the supposed, but unknown support of those qualities we find existing, which we imagine cannot subsist 'sine re substante,' without something to support them, we call that support substantia; which, according to the true import of the word, is in plain English, standing under or upholding." It is to be noted further that Locke does not deny the reality of substance, but only that it can be known. This he makes clear in a letter to Stillingfleet, saying: "The being of substance would not be at all shaken by my saying, that we had but an obscure imperfect idea of it" (quoted from a footnote by the editors of the *Works*, *Works*, II, 3). The same point was made in 1671 in *Draft A*, p. 4.

⁴² *Essay*, IV, xiii, 10, *Works*, III, 79. Locke makes a very similar statement in *Some Thoughts concerning Education*, where he writes: "Natural philosophy, as a speculative science, I imagine we have none; and perhaps I may think I have reason to say, we never shall be able to make a science of it. The works of nature are contrived by a wisdom and operate by ways too far surpassing our faculties to discover or capacities to conceive, for us ever to be able to reduce them into a science. Natural philosophy being the knowledge of the principles, properties, and operations of things as they are in themselves, I imagine there are two parts of it, one comprehending spirits with their nature and qualities, and the other bodies" (*Locke Selections*, ed. Sterling P. Lamprecht [New York, 1956], p. 11).

discoverable and warrant assent. The second is that nature can still be controlled for the use of man. Locke's utilitarianism clearly appears in his statement: "Experiments and historical observations we may have, from which we may draw advantage of ease and health, and thereby increase our stock of conveniences for this life; but beyond this I fear our talents reach not, nor are our faculties, as I guess, able to advance."⁴³ The restriction of man's energies to description and use rather than to explanation is a situation Locke does not find too burdensome. Indeed, it has for him a theological justification. In the first place, that man has such knowledge as is sufficient for his situation enables him to realize that God cares for him and has not left him destitute, and second, the awareness of one's own imperfections is the best stimulus one can have to seek and worship the perfect God.

So far Locke's views have been considered in their most general formulation, with reference often made to a primary interest of himself and his friends, science. His views on certainty are also formulated relative to two of his other interests, morals and religion. In both the *Essay* and the *Third Letter for Toleration*⁴⁴ an epistemological thesis is made a basis for the ethical principle of toleration, a principle which receives its full exposition in the latter work. In the *Essay* Locke had argued that of the great variety of beliefs on which the affairs of life turn the majority are only probable. He points out further that there are so many particulars relevant to belief that no one has either the time, leisure, or ability to consider every relevant fact before making a judgment. Consequently, when one does make a judgment he cannot be sure "that there is no evidence behind, and yet unseen, which may cast the probability on the other side, and outweigh all that at present seems to preponderate with us."⁴⁵ Since in matters which are only probable, and Locke refers particularly to religion, no one has the whole truth, and since another person's views may be as correct as one's own, or perhaps even more so, it would seem the better course of action for men to respect one another's views. In the *Third Letter* he emphasizes

⁴³ *Essay*, IV, xii, 10, *Works*, III, 79; see also the Journal entry for 8 February 1677, King, pp. 89-91.

⁴⁴ *A Third Letter for Toleration* was first published in 1690. It was written in reply to Jonas Proust's attacks on the first and second letters of 1689 and 1690.

⁴⁵ *Essay*, IV, xvi, 3, *Works*, III, 94. He writes further: "Since therefore it is unavoidable to the greatest part of men, if not all, to have several opinions, without certain and indubitable proofs of their truth ... it would methinks become all men to maintain peace, and the common offices of humanity and friendship, in the diversity of opinions, since we cannot reasonably expect, that any one should readily and obsequiously quit his own opinion, and embrace ours with a blind resignation to an authority, which the understanding of man acknowledges not."

not so much the diversity in the evidence and the difficulty in securing all of it, as the differences among men arising from education, temperament, prejudice, and so forth, which affect their being persuaded of the truth of a doctrine, and makes this a basis for the doctrine of toleration developed there. He writes:

Whatever gains any man's assent, one may be sure had sufficient evidence in respect of that man: but that is far enough from proving it evidence sufficient to prevail on another, let him consider it as long and as much as he can. The temper of man's minds, the principles settled there by time and education, beyond the power of the man himself to alter them; the different capacities of men's understandings, and the strange ideas they are often filled with; are so various and uncertain, that it is impossible to find that evidence, especially in things of a mixed disposition, depending on so long a train of consequences, as some points of the true religion may, which one can confidently say, will be sufficient for all men.⁴⁶

As a consequence of this difference in temperaments and in what persuades a person to give assent, Locke thinks that no one, especially the governor of a state, is really justified in imposing his own views on others or demanding that other persons recognize his view as the whole truth.

The doctrine of probability in Locke's epistemology also plays a significant role in his attack on enthusiasm in religion. Enthusiasm Locke takes to be the attitude of those who "have often flattered themselves of an immediate intercourse with the Deity, and frequent communications from the Divine Spirit."⁴⁷ Religious fanatics claim revelation as the only source of their beliefs and divorce revelation from reason, a procedure which gives them a way "of illumination without search, of certainty without proof, and without examination."⁴⁸ Aside from such psychological factors as excessive devotion, self-conceit, and an over-indulgence of natural inclinations, the source of enthusiasm is the failure to appreciate the role of reason in religious belief. Locke's account is that, however contrary a revealed statement may seem to reason, it can be accepted as true so long as it can be shown that revelation occurred. This, being a matter of fact, is to be established like any other factual matter. Since acceptance of a revealed doctrine depends upon the credibility of its being a revelation, the intensity of assent to the former can or ought never to exceed the intensity of assent to the latter. The fanatic, according to Locke, accepts a doctrine as though it were a revelation or illumination, but leaves unanswered the question whether it genuinely is or not. He thus lays aside the principle that assent must be proportioned to evidence.

⁴⁶ *A Third Letter for Toleration*, *Works*, VI, 297.

⁴⁷ *Essay*, IV, xix, 5, *Works*, III, 137.

⁴⁸ *Ibid.*, IV, xix, 8, *Works*, III, 138.

In Locke's writings, particularly the *Essay*, are thus found the major themes initially developed by Chillingworth and Tillotson with respect to a religious controversy, by Wilkins with respect to the founding of natural religion, and by Glanvill, Boyle, and Newton with respect to the theory and practice of science. These are made by him basic principles of an empirical theory of knowledge. While the account we have given of his views does not pretend to be a complete one of the sources and influences upon his thought, it does give his views on certainty continuity with those of his countrymen. In his descriptive account of the strengths and weaknesses of the human mind he finds that truth is a goal very difficult to achieve. He finds that absolute certainty, particularly about the structure and operations of physical nature and spirit, is simply beyond man's capacity to grasp. Such infallible certainty as one has is based upon intuition, which itself is not subject to the scrutiny of reason, and which yields little or no information about the real world. The passive role of the senses, the fallibility of the mind, both memory and reason, and the complexity of nature make the attainment of truth a near impossibility. As a consequence the enterprise of science as a demonstrative system and of metaphysics as an account of the real structure of nature become impossible. Uncertainty and skepticism are not, however, stopping places for the human mind. Rather, they are the inspiration for an alternative program which will be practically serviceable for the needs of man in a world created by God. Locke accepts the doctrine that belief must be proportioned to evidence and that there are levels of both, ranging from intuition which yields infallible certainty down to the almost worthless evidence of common opinion which yields virtually no certainty at all. He develops the view that the certainty based on such evidence as is presently within reach will suffice for the great concerns of life – science, religion, moral action, commerce and trade – and for the humbler occupations of ordinary men. Scientific laws at their best are descriptions of observed regularities; though very probably true they can never amount to knowledge. Since few, if any, religious or political beliefs can be proved to be true, Locke makes it a cardinal feature of his ethics that toleration be practiced. His views on certainty are thus a generalization and application of views developed earlier with respect to particular problems; taken together with his analysis of the origin of ideas and his theory of language, they constitute a complete theory of knowledge, generally known as British empiricism.

Without question Locke's theory of knowledge has deeply affected

British philosophy since the publication of the *Essay* in 1690. Insofar as the problem of certainty plays so great a role in his thought, it is natural to conclude that one of the keys to the understanding of British philosophy past and present is the question of the certainty of human knowledge. The appeal to common sense, the emphasis upon utility and practical consequences, and the deep interest in the psychological aspects of knowledge are undoubtedly inspired in large part by Locke's *Essay*. If, as is generally acknowledged, British epistemology can be best understood through its relation to Locke's philosophical writings, it then follows that the English Protestant solution to the Rule of Faith controversy is of great historical importance to the understanding of British thought to the present. How, and to what extent, such influence has been effected is too complex to be detailed within the confines of such an essay as this; however, some suggestions can be made by way of a general conclusion.

CONCLUSION

It was stated at the outset that the aim of this study was to examine a particular theory of certainty developed in England between 1630 and 1690, first in the area of theology and then in science. The major features of the theory as we have examined it can be set out as follows. In the first place there is a recognition of an ideal in knowledge, that the real essence or internal structure of things – the inner springs and wheels of nature, to use the common mechanical metaphor – can be known. Second, there is a hope that science as a demonstrative system and metaphysics are both possible. But whatever the expectations may be, there is a realistic recognition that they cannot be fulfilled since critical arguments can be raised against any claim to absolute certainty. The senses are recognized to be deceptive in their reports – distance, medium, size, and familiarity of the object all affect perception – and subjective in orientation. The mind's ability to weigh evidence and to see connections among its ideas as well as between ideas and real objects, is problematic on account of prejudice, the passions, the failure of memory, and the fall of man. The complexity of nature is recognized as a problem too. These three factors, if taken together and considered seriously, could lead to a complete skepticism about nature. However, an attempt is made to avoid such a conclusion as destructive of life, if not of knowledge alone. The position developed is one, as noted before, that can be called "constructive scepticism." This position takes seriously the claims of skepticism but refuses to acknowledge their finality. Insofar as these arguments cannot be overcome but are simply put aside, there seems to be an acknowledgement of a fundamental irrationalism, namely that reason is, in the last analysis, unable to cope with the real and bring it within the range of comprehension. In this respect the ultimacy of skepticism is acknowledged, but is not permitted to destroy the practical activities of life nor all claims

to certainty. Some evidence is still within reach and on the basis of it some certainty can be had. It is recognized that ordinary persons are *not affected by skeptical doubts, but are certain in spite of them*, or rather, pay no attention to them. To each kind of evidence an appropriate kind or level of certainty is matched. The levels of certainty range from near absolute certainty in the case of identical or self-evident propositions, to demonstrative certainty in the case of mathematical and metaphysical ones, down to the various degrees of moral certainty for the vast majority of beliefs concerning the major enterprises of life – travel, commerce and trade, religion and science – and to mere probability where the evidence is ambiguous. Incorporated in the level of moral certainty is the notion of reasonable doubt, that is, the notion that a belief can be accepted as true when there is such evidence for it as would sway the assent of a normal rational person. The mere possibility of things being otherwise is taken to be no reasonable ground for doubt. There is the implication, to be taken seriously, that the level of certainty of ordinary persons in life's common situations is to be made the standard of certainty for the philosopher too. The position as so developed can justifiably be called constructive skepticism in that it admits on the one hand that skeptical arguments are destructive of the ideals of theological and scientific knowledge, but on the other attempts to accommodate itself to the situation by making as good a case as possible for the mind's relation to reality and truth.

Finally, this theory about certainty differs, as we have shown, from that of Francis Bacon, the reputed father of experimental science. Bacon's passion for collecting factual data as the basis for generalization, his interest in unearthing the secrets of nature, and his concern to utilize such results for the improvement of human life, are all features of the theory of science for which he is held in esteem. However, the theory of certainty he developed is not the one later accepted by his scientific successors and thus, insofar as a theory of certainty is integral to scientific method, Bacon is not the founder of modern science. His method aims at the discovery of necessary truth about the real forms of things, that is, their natures, and both these claims are acknowledged as too difficult, if not impossible, to attain for the reasons summarized in the foregoing paragraph.

Having thus stated in conclusion the theory whose development we have traced from its theological origins to its full scientific and philosophical expression, the question can be legitimately asked as to what

became of it in subsequent European and British thought. To answer this question in detail would be a task far beyond the limits of such a study as this, much more so of its concluding paragraphs. However, some indication can be given of its reception on the continent and of at least one reaction to it in British thought, namely that of David Hume. The views we have been examining, particularly as they were developed in the Royal Society, did not go without notice on the continent. The French Bishop of Avranches, Pierre Daniel Huet (1630–1721), for example, in his *Traité Philosophique de la Faiblesse Humain* praises the Society for having made a significant advance over previous scientific accomplishments:

Cette nouvelle Société de Philosophes Anglois, qui a élevé tant d'excellens Esprits, condamne l'arrogance des Dogmatiques, & sans s'attacher à aucune Secte, elle s'employe uniquement à choisir & à cultiver ce que l'on a trouvé jusqu'ici de meilleur, ou à trouver quelque chose de mieux; plus digne d'être suivie par ceux qui viendront apres elle, que de suivre ceux qui l'ont devancée.¹

A more incisive insight into what was occurring in scientific circles is given by Pierre Bayle (1647–1706) in his *Dictionary Historical and Critical*, in which he notes the fundamentally skeptical character of the new scientific movement, and adds that such skepticism is not destructive of science. In the article “Pyrrho” he writes:

Pyrrhonism ... is not very dangerous with respect to Natural Philosophy or the state. There is no harm in saying, that the souls of men are too narrow to discover any thing in natural truths, in the causes which produce heat, cold, the flux of the sea, &c. It is enough for us to endeavour to find out some probable hypotheses and to make a collection of experiments; and I am sure that there are very few good Natural Philosophers in our age, but are convinced, that nature is an impenetrable abyss, and that its springs are known to none, but to the maker and director of them. So that all these Philosophers are, in that respect, Academics and Pyrrhonists.²

Bayle here acknowledges the impenetrability of the secrets of nature, the inability of man to understand her inner springs (note the mechanical metaphor), and that explanatory natural philosophy is possible only to God. All that the scientist can do is to devise descriptive hypotheses to account for the phenomena; to the extent these give an acceptable account of the workings of nature science is not destroyed. It is significant too that he aligns the new science with the Academic and Pyrrhonian skeptics of ancient Greece, for they also taught that the inner recesses of nature were inaccessible and beyond the reach of the

¹ Pierre Daniel Huet, *Traité Philosophique de la Faiblesse Humain* (Amsterdam, 1723), p. 221.

² Pierre Bayle, *The Dictionary Historical and Critical of Mr. Peter Bayle*, 5 vols. (London, 1737), art. “Pyrrho,” IV, 653, note B.

human mind; similarly, they did not deny altogether the possibility of knowledge but only that a greater than probable certainty was ever possible.

In the tradition examined an attempt is made to set up some kind of intellectual order in a world that is fundamentally irrational. From Chillingworth to Wilkins and from Glanvill to Locke, the admission is a common one that the inner structure of nature – the real causes of natural events – is opaque to the human mind. In such a case one can only describe what happens, not give an explanation of it. Hume admits all this to be the case but goes one step further and argues that the account of certainty they develop is itself subject to critical difficulties. Even if one assumes that the senses and reason are not fundamentally deceptive, problems still arise which reduce knowledge to probability, and probability to uncertainty. This he shows in various ways in his major works.

The context in which the theory of certainty originated was that of religion; Chillingworth, Tillotson, and Wilkins were all clerics who formulated their views on certainty with respect to religious problems. It is of interest to note that in his essay "On Miracles"³ and in his last writing and posthumously published *Dialogues Concerning Natural Religion*⁴ Hume applies his analysis of knowledge to religious problems. In the essay, which opens with a reference to one of Tillotson's essays, he challenges justification of belief in the occurrence of miracles, basing his objection upon a dialectical use against itself of the principle that assent must be proportioned to evidence. Hume points out that experience, which includes testimony, is the only basis for reasoning concerning matters of fact, and is not infallible though it may range in certainty: "... there are all imaginable degrees of assurance, from the highest certainty to the lowest species of moral evidence."⁵ He regards it as typical of a wise man to proceed with caution in making his judgments and to proportion his belief to the evidence. Contrary evidence, he notes, arises when witnesses contradict one another, when they are few in number or are of a disputable character, when they have a personal stake in what they are testifying about, or when they are too hesitant or forward in their presentation – the contrary of which

³ This essay occurs as Section X of David Hume's *An Enquiry Concerning Human Understanding* in *Enquiries Concerning the Human Understanding and Concerning the Principles of Morals*, ed. L. A. Selby-Bigge, 2nd ed. (Oxford, reprint of 1951).

⁴ David Hume, *Dialogues Concerning Natural Religion*, ed. Henry D. Aiken (New York, 1955).

⁵ *Enquiries*, p. 110; see also p. 112.

factors were regarded as essential to well grounded testimony by such a member of the Royal Society group as Locke.

Hume tries to show that it is not probable, much less a proof, that one knows on the basis of testimony that a miracle has occurred. On the basis of experience one can become highly certain of the reliability of witnesses and also about the occurrence of certain types of events. Should testimony be given of the occurrence of a miraculous event, even testimony amounting to a full proof, it is immediately and wholly counterbalanced by the proof for the law to which the miracle is an exception:

A miracle is a violation of the laws of nature ... There must, therefore, be a uniform experience against every miraculous event, otherwise the event would not merit that appellation. And as a uniform experience amounts to a proof, there is here a direct and full *proof*, from the nature of the fact against the existence of any miracle; nor can such a proof be destroyed, or miracle rendered credible but by an opposite proof which is superior.⁶

Since the proof for the natural law being violated is as great as for the miracle, a person proportioning his assent to the evidence would find himself at a standstill. Hume then continues his argument by pointing out factors which preclude the evidence for the miracle from ever amounting to a full proof. Thus if one accepts the principle of the proportioning of belief to evidence, then, since at best the evidence for a miracle amounts to a probability and the evidence for the law it violates constitutes a proof, belief in the occurrence of a miracle is wholly unjustified.

In the *Dialogues Concerning Natural Religion* Hume, in the person of Philo, subjects to merciless criticism a theoretical basis for religious belief which in many ways resembles or is a fundamental part of the view we have been examining, and shows that acceptance of it will lead to the annihilation of rationally justified religious belief. In the *Dialogues* the character Cleanthes is given a position in most respects similar to the constructive skepticism sketched above. His position is called by Hume refined or philosophical skepticism and is described as follows:

They push their researches into the most abstruse corners of science, and their assent attends them in every step, proportioned to the evidence which they meet with. They are even obliged to acknowledge that the most abstruse and remote objects are those which are best explained by philosophy. Light is in reality anatomized; the true system of the heavenly bodies is discovered and ascertained. But the nourishment of bodies by food is still an inexplicable mystery; the cohesion of the parts of matter is still incomprehensible. These sceptics, therefore, are obliged in every question, to consider each particular evidence apart,

⁶ *Ibid.*, pp. 114-115.

and proportion their assent to the precise degree of evidence which occurs. This is their practice in all natural, mathematical, moral, and political science. And why not the same, I ask, in the theological and religious? ⁷

Reference is made here to some of the accomplishments of recent scientific investigations – the analysis of light and celestial dynamics, it should be noted, were the achievements of Hume’s scientific hero, Newton – and to the fact that some of the more common features of nature, the assimilation of food and the cohesion of bodies, are not understood. These latter being “incomprehensible” and “inexplicable,” one can do no better than proportion his assent to such evidence as the scientist can discover. In matters of religion Cleanthes and Philo have certain views in common, particularly that reason of itself is unable to discover the truth of the fundamental propositions of theology, as is made evident by their joint attack on the demonstrative proof by Demea of the existence of God. However, taking the moderate position of Cleanthes that religious propositions are not the most certain, since the evidence for them is less than perfect and of the same kind as for scientific ones, Philo shows during the course of the *Dialogues* that even this position leads to absurdity. The main thrust of Philo’s argument is to show that if one accepts the principle that assent and evidence are proportioned, religion is in particularly dire straits since skeptical arguments can be raised against every bit of evidence that is brought forward. Philo’s attack is based on the two principles that all ideas are based on experience, and that one has no experience of divine attributes or operations, leaving it to the reader to conclude that there is no knowledge of God. Against the argument from analogy he points out that the world is as analogous to an animal as to a house and therefore is as likely to have an egg for a cause as a divine architect. Against the argument from design he points out that in many respects the world is chaotic in structure, and the presence of evil makes it impossible to infer that God exists, much less that he is good. “And from thence I conclude that, however consistent the world may be, allowing certain suppositions and conjectures with the idea of such a Deity, it can never afford us an inference concerning his existence. The consistency is not absolutely denied, only the inference.” ⁸ Since on Cleanthes’ view one

⁷ *Dialogues*, p. 11.

⁸ *Ibid.*, p. 73. It is interesting to note in this connection that all the kinds of evidence Wilkins had used in *Natural Religion* to prove God’s existence are challenged in the *Dialogues*. Wilkins had made an appeal to the universal consent of mankind, to the finite temporality of the world, to the “Admirable Contrivance of Natural Things,” and to the providential government of the world (*Natural Religion*, Chapters IV–VII), each of which is attacked by Philo.

is to proportion belief to evidence, and since Philo shows that all the evidence is at best worthless, religious belief is left with no rational justification.

Hume's major contentions relative to the tradition we have been examining occur toward the end of *An Enquiry Concerning Human Understanding* and in the fourth part of Book I of *A Treatise of Human Nature*. In the *Enquiry* a distinction is made between Cartesian skepticism, which occurs prior to knowledge, and a skepticism which can be raised consequent to the discovery of truth.⁹ Hume, as did his predecessors, rejects the Cartesian type of doubt on the ground that if one were to doubt everything nothing could be established as true. In the tradition of his predecessors the practice of doubting everything simply on the ground that it may be false is rejected as an unacceptable procedure. There is an admission that such doubts can be raised but a refusal to acknowledge such a procedure as final; there is a preference instead for the constructive and pragmatic approach of considering such evidence as is available and proportioning assent to it. But Hume's further argument is that even if one takes such an approach as this, arguments can still be raised which will destroy all belief, as it depends both on the senses and on reason.

Of Hume's arguments against knowledge based on sense perception one is of particular interest here. Most of the Royal Society group justified confidence in the reports of the senses on the ground of an implicit faith in the reliability of the senses, usually basing this principle upon God's veracity. This Hume points out to be an untenable conviction on two grounds. First, if God's veracity is involved in trust in the senses, no errors of perception ought ever to occur since God could never deceive. But since it is universally acknowledged that such errors do occur, God cannot be made guarantor without impeaching his integrity. Second, argues Hume, dependence upon God for knowledge of physical objects involves a circularity for it is only through a knowledge of physical nature that one could ever prove God's existence.¹⁰

In the *Treatise* Hume undertakes to show that knowledge and probability, even as developed within the framework constructed by the Royal Society group, are subject to insuperable difficulties. Hume founds his arguments against knowledge based on reason on a principle used a hundred years earlier by Chillingworth in his attack on Knott. He writes: "In all demonstrative sciences the rules are certain and

⁹ *Enquiries*, pp. 149-151.

¹⁰ *Ibid.*, p. 153.

infallible; but when we apply them, our fallible and uncertain faculties are very apt to depart from them, and fall into error.”¹¹ Since error occurs primarily in the application of rules in the reasoning process, one must judge in each instance whether the rules were correctly applied. If this judgment about the rules is true then the original judgment could be accepted as genuine knowledge with the attendant degree of certainty, but since the same kind of question is relevant concerning the judgment about the application of the rules, one can at best get probability in any judgment. Since factors other than the correct application of rules may have been inadvertently introduced – as one is aware they have been in the past – the original demonstration can never exceed probability. The degree of probability of a demonstrative argument, Hume adds, depends upon two factors, the trustworthiness of the faculties and the complexity of the original problem, and is of the same level of probability as that attainable in common situations in ordinary life.

Against this level of certainty, presumably what the Royal Society group would call ‘moral certainty,’ arguments similar to those above can be brought. In each probable judgment a further judgment must be made to determine whether the original one was correctly made. Since everyone is conscious of having made errors in the past and suspects that they may occur again, it is always legitimate to raise the question whether the original judgment was correctly made. Since the probability of the original together with the probability of the judgment about the faculties makes a judgment less certain than the original, and since the process of raising the question concerning the correctness of the reasoning can be carried on indefinitely, there results, says Hume, “a total extinction of belief and evidence.”

There is one further point in Hume’s philosophy that is of interest here. One of the distinctions made by the scientists Boyle and Newton, and by Locke, is between primary and secondary qualities of objects. It was acknowledged that only the latter come within the range of experience and that only in terms of them could a descriptive account of nature be given. The primary qualities being unknown and the relation between them and secondary qualities not being discoverable, the real nature of things – “the springs and wheels that set the rest in motion,” to use Glanvill’s phrase – remains unknown, a situation which makes science as an explanatory account of nature impossible. Hume carries

¹¹ *Treatise*, p. 180; see also in this connection Chillingworth’s *Religion of Protestants*, *Works*, p. 204.

this analysis one step further.¹² Rather than say the primary are the real but unknown qualities of things, he claims they have the same status as the secondary ones. To know motion one must previously know the extension and solidity of an object, and to know the extension of an object one must previously know its color. Since color is a secondary quality, extension can be no more. Solidity is not a simple idea since two bodies are required for its occurrence, and it cannot be made to depend on extension, color, or motion without a circular argument. Finally, there is no impression of solidity through the senses – it would then be a secondary quality – and there seems to be no resemblance between the idea of solidity and one's feeling something solid. In short, the distinction between primary and secondary qualities seems not to be a defensible one, and insofar as the reality of objects was thought to depend upon the objectivity of primary qualities, "we utterly annihilate all these objects, and reduce ourselves to the most extravagant scepticism concerning them."¹³ Thus, insofar as in the new science the ideal of a complete explanation of natural phenomena was to be achieved in terms of the discovery of primary qualities, Hume renders the ideal an impossibility by reducing, as he thought Newton had done, the basis for explanation to a phenomenal level.

These arguments against the theory of knowledge of his predecessors Hume regarded as subverting all efforts at justifying belief and as theoretically unanswerable. So far as they are valid they show that even if one attempts to establish a limited kind of certainty within the confines of an ultimately irrational world one is doomed to failure, for the irrationality re-asserts itself and the arguments used to establish limited certainty destroy that certainty too. In short, reason, even the reason of common sense is an inadequate justification for belief. This is not to say, however, that Hume found the conclusions of his own arguments convincing. Indeed, he did not, for he found himself believing in spite of his own skeptical conclusions. At the end of the *Dialogues* Philo finds himself under the force of a "natural propensity," and believes as strongly as Cleanthes in the existence and rationality of God. In the *Treatise*, after formulating the arguments presented above, he answers in the negative the question whether he is a genuine skeptic. Nature, he says, breaks the force of skeptical arguments. He believes everything that any ordinary person does, even though there is no positive rational justification for such belief.

¹² *Enquiries*, pp. 154–155; see also *Treatise*, pp. 225–231.

¹³ *Treatise*, p. 228.

“ ‘Tis happy therefore, that nature breaks the force of all sceptical arguments in time, and keeps them from having any considerable influence on the understanding ... Thus the sceptic still continues to reason and believe, even tho’ he asserts, that he cannot defend his reason by reason ...”¹⁴ To pursue in further detail Hume’s solution to the crisis raised by skepticism is not our task here. However, it will be of some value by way of conclusion to note some general aspects of British thought as affected by the tradition we have examined and Hume’s reaction to it.

There is a consequence of Hume’s theoretical subversion of the theory of knowledge developed between 1630 and 1690 that is worth noting for its impact upon subsequent British philosophy. His arguments show that the certainty of ordinary men and the principles of common sense are inadequate from a theoretical point of view when raised to the level of a theory of knowledge. They show the pragmatic and subjective solutions to skepticism to be inadequate to the complexity of the problem. However, such criticisms did not prevent common sense from becoming an integral part of post-Humean British thought. Immediately after the publication of Hume’s views a reaction set in against them in the writings of the Common Sense School of Scottish philosophy. This appeal to common sense is one that was not unique to the eighteenth century, but is still alive in British thought. Closely allied to this is the contemporary interest in the psychological aspects of knowledge and in the role of feeling and temperament in the development of a philosophical view. On the other side, there is also in British positivistic thought an extension of the earlier skeptical and anti-metaphysical tendencies, though these are more often traced back to Hume than to his predecessors. Given these tendencies in British philosophy as they have developed from the theories of Locke and Hume, one cannot but conclude that the solution by English Protestantism to a theological problem, as it was expanded in the Royal Society and generalized by Locke, is integral to a complete historical understanding of British philosophy.

¹⁴ *Ibid.*, p. 187.

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