The Enlightenment

Old Western Culture Reader

Volume 15

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Enlightenment is man’s emergence from his self-imposed nonage. Nonage is the inability to use one’s own understanding without another’s guidance. This nonage is self-imposed if its cause lies not in lack of understanding but in indecision and lack of courage to use one’s own mind without another’s guidance. Dare to know! (Sapere aude.) “Have the courage to use your own understanding,” is therefore the motto of the enlightenment.

Laziness and cowardice are the reasons why such a large part of mankind gladly remain minors all their lives, long after nature has freed them from external guidance. They are the reasons why it is so easy for others to set themselves up as guardians. It is so comfortable to be a minor. If I have a book that thinks for me, a pastor who acts

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1 Period of youth or immaturity. Mitch Stokes, in the lecture associated with this reading, uses the term “self-imposed tutelage.”
as my conscience, a physician who prescribes my diet, and so on—then
I have no need to exert myself. I have no need to think, if only I can
pay; others will take care of that disagreeable business for me. Those
guardians who have kindly taken supervision upon themselves see to
it that the overwhelming majority of mankind—among them the entire
fair sex—should consider the step to maturity, not only as hard, but
as extremely dangerous. First, these guardians make their domestic
cattle stupid and carefully prevent the docile creatures from taking
a single step without the leading-strings to which they have fastened
them. Then they show them the danger that would threaten them if
they should try to walk by themselves. Now this danger is really not
very great; after stumbling a few times they would, at last, learn to
walk. However, examples of such failures intimidate and generally
discourage all further attempts.

Thus it is very difficult for the individual to work himself out of
the nonage which has become almost second nature to him. He has
even grown to like it, and is at first really incapable of using his own
understanding because he has never been permitted to try it. Dogmas
and formulas, these mechanical tools designed for reasonable use—
or rather abuse—of his natural gifts, are the fetters of an everlasting
nonage. The man who casts them off would make an uncertain leap
over the narrowest ditch, because he is not used to such free move-
ment. That is why there are only a few men who walk firmly, and who
have emerged from nonage by cultivating their own minds.

It is more nearly possible, however, for the public to enlighten
itself; indeed, if it is only given freedom, enlightenment is almost
inevitable. There will always be a few independent thinkers, even
among the self-appointed guardians of the multitude. Once such men
have thrown off the yoke of nonage, they will spread about them the
spirit of a reasonable appreciation of man’s value and of his duty to
think for himself. It is especially to be noted that the public which was
earlier brought under the yoke by these men afterwards forces these
very guardians to remain in submission, if it is so incited by some of its
guardians who are themselves incapable of any enlightenment. That
shows how pernicious it is to implant prejudices: they will eventually
revenge themselves upon their authors or their authors’ descendants.
Therefore, a public can achieve enlightenment only slowly. A revolution may bring about the end of a personal despotism or of avaricious tyrannical oppression, but never a true reform of modes of thought. New prejudices will serve, in place of the old, as guidelines for the unthinking multitude.

This enlightenment requires nothing but *freedom*—and the most innocent of all that may be called “freedom”: freedom to make public use of one’s reason in all matters. Now I hear the cry from all sides: “Do not argue!” The officer says: “Do not argue—drill!” The tax collector: “Do not argue—pay!” The pastor: “Do not argue—believe!” Only one ruler in the world says: “Argue as much as you please, but obey!” We find restrictions on freedom everywhere. But which restriction is harmful to enlightenment? Which restriction is innocent, and which advances enlightenment? I reply: the public use of one’s reason must be free at all times, and this alone can bring enlightenment to mankind.

On the other hand, the private use of reason may frequently be narrowly restricted without especially hindering the progress of enlightenment. By “public use of one’s reason” I mean that use which a man, as *scholar*, makes of it before the reading public. I call “private use” that use which a man makes of his reason in a civic post that has been entrusted to him. In some affairs affecting the interest of the community a certain [governmental] mechanism is necessary in which some members of the community remain passive. This creates an artificial unanimity which will serve the fulfillment of public objectives, or at least keep these objectives from being destroyed. Here arguing is not permitted: one must obey. Insofar as a part of this machine considers himself at the same time a member of a universal community—a world society of citizens—(let us say that he thinks of himself as a scholar rationally addressing his public through his writings) he may indeed argue, and the affairs with which he is associated in part as a passive member will not suffer. Thus it would be very unfortunate if an officer on duty and under orders from his superiors should want to criticize the appropriateness or utility of his orders. He must obey. But as a scholar he could not rightfully be prevented from taking notice of the mistakes in the military service
and from submitting his views to his public for its judgment. The citizen cannot refuse to pay the taxes levied upon him; indeed, impertinent censure of such taxes could be punished as a scandal that might cause general disobedience. Nevertheless, this man does not violate the duties of a citizen if, as a scholar, he publicly expresses his objections to the impropriety or possible injustice of such levies. A pastor, too, is bound to preach to his congregation in accord with the doctrines of the church which he serves, for he was ordained on that condition. But as a scholar he has full freedom, indeed the obligation, to communicate to his public all his carefully examined and constructive thoughts concerning errors in that doctrine and his proposals concerning improvement of religious dogma and church institutions. This is nothing that could burden his conscience. For what he teaches in pursuance of his office as representative of the church, he represents as something which he is not free to teach as he sees it. He speaks as one who is employed to speak in the name and under the orders of another. He will say: “Our church teaches this or that; these are the proofs which it employs.” Thus he will benefit his congregation as much as possible by presenting doctrines to which he may not subscribe with full conviction. He can commit himself to teach them because it is not completely impossible that they may contain hidden truth. In any event, he has found nothing in the doctrines that contradicts the heart of religion. For if he believed that such contradictions existed he would not be able to administer his office with a clear conscience. He would have to resign it. Therefore the use which a scholar makes of his reason before the congregation that employs him is only a private use, for no matter how sizable, this is only a domestic audience. In view of this he, as preacher, is not free and ought not to be free, since he is carrying out the orders of others. On the other hand, as the scholar who speaks to his own public (the world) through his writings, the minister in the public use of his reason enjoys unlimited freedom to use his own reason and to speak for himself. That the spiritual guardians of the people should themselves be treated as minors is an absurdity which would result in perpetuating absurdities.
But should a society of ministers, say a Church Council, . . . have the right to commit itself by oath to a certain unalterable doctrine, in order to secure perpetual guardianship over all its members and through them over the people? I say that this is quite impossible. Such a contract, concluded to keep all further enlightenment from humanity, is simply null and void even if it should be confirmed by the sovereign power, by parliaments, and the most solemn treaties. An epoch cannot conclude a pact that will commit succeeding ages, prevent them from increasing their significant insights, purging themselves of errors, and generally progressing in enlightenment. That would be a crime against human nature whose proper destiny lies precisely in such progress. Therefore, succeeding ages are fully entitled to repudiate such decisions as unauthorized and outrageous. The touchstone of all those decisions that may be made into law for a people lies in this question: Could a people impose such a law upon itself? Now it might be possible to introduce a certain order for a definite short period of time in expectation of better order. But, while this provisional order continues, each citizen (above all, each pastor acting as a scholar) should be left free to publish his criticisms of the faults of existing institutions. This should continue until public understanding of these matters has gone so far that, by uniting the voices of many (although not necessarily all) scholars, reform proposals could be brought before the sovereign to protect those congregations which had decided according to their best lights upon an altered religious order, without, however, hindering those who want to remain true to the old institutions. But to agree to a perpetual religious constitution which is not publicly questioned by anyone would be, as it were, to annihilate a period of time in the progress of man’s improvement. This must be absolutely forbidden.

A man may postpone his own enlightenment, but only for a limited period of time. And to give up enlightenment altogether, either for oneself or one’s descendants, is to violate and to trample upon the sacred rights of man. What a people may not decide for itself may even less be decided for it by a monarch, for his reputation as a ruler consists precisely in the way in which he unites the will of the whole people within his own. If he only sees to it that all true or supposed
[religious] improvement remains in step with the civic order, he can for the rest leave his subjects alone to do what they find necessary for the salvation of their souls. Salvation is none of his business; it is his business to prevent one man from forcibly keeping another from determining and promoting his salvation to the best of his ability. Indeed, it would be prejudicial to his majesty if he meddled in these matters and supervised the writings in which his subjects seek to bring their [religious] views into the open, even when he does this from his own highest insight, because then he exposes himself to the reproach: *Caesar non est supra grammaticos.* It is worse when he debases his sovereign power so far as to support the spiritual despotism of a few tyrants in his state over the rest of his subjects.

When we ask, Are we now living in an enlightened age? the answer is, No, but we live in an age of enlightenment. As matters now stand it is still far from true that men are already capable of using their own reason in religious matters confidently and correctly without external guidance. Still, we have some obvious indications that the field of working toward the goal [of religious truth] is now opened. What is more, the hindrances against general enlightenment or the emergence from self-imposed nonage are gradually diminishing. In this respect this is the age of the enlightenment and the century of Frederick [the Great].

A prince ought not to deem it beneath his dignity to state that he considers it his duty not to dictate anything to his subjects in religious matters, but to leave them complete freedom. If he repudiates the arrogant word “tolerant”, he is himself enlightened; he deserves to be praised by a grateful world and posterity as that man who was the first to liberate mankind from dependence, at least on the government, and let everybody use his own reason in matters of conscience. Under his reign, honorable pastors, acting as scholars and regardless of the duties of their office, can freely and openly publish their ideas to the world for inspection, although they deviate here and there from accepted doctrine. This is even more true of every person not restrained by any oath of office. This spirit of freedom is spreading

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2 Caesar is not above grammarians.
beyond the boundaries [of Prussia] even where it has to struggle against the external hindrances established by a government that fails to grasp its true interest. [Frederick’s Prussia] is a shining example that freedom need not cause the least worry concerning public order or the unity of the community. When one does not deliberately attempt to keep men in barbarism, they will gradually work out of that condition by themselves.

I have emphasized the main point of the enlightenment—man’s emergence from his self-imposed nonage—primarily in religious matters, because our rulers have no interest in playing the guardian to their subjects in the arts and sciences. Above all, nonage in religion is not only the most harmful but the most dishonorable. But the disposition of a sovereign ruler who favors freedom in the arts and sciences goes even further: he knows that there is no danger in permitting his subjects to make public use of their reason and to publish their ideas concerning a better constitution, as well as candid criticism of existing basic laws. We already have a striking example [of such freedom], and no monarch can match the one whom we venerate.

But only the man who is himself enlightened, who is not afraid of shadows, and who commands at the same time a well disciplined and numerous army as guarantor of public peace—only he can say what [the sovereign of] a free state cannot dare to say: “Argue as much as you like, and about what you like, but obey!” Thus we observe here as elsewhere in human affairs, in which almost everything is paradoxical, a surprising and unexpected course of events: a large degree of civic freedom appears to be of advantage to the intellectual freedom of the people, yet at the same time it establishes insurmountable barriers. A lesser degree of civic freedom, however, creates room to let that free spirit expand to the limits of its capacity. Nature, then, has carefully cultivated the seed within the hard core—namely the urge for and the vocation of free thought. And this free thought gradually reacts back on the modes of thought of the people, and men become more and more capable of acting in freedom. At last free thought acts even on the fundamentals of government and the state finds it agreeable to treat man, who is now more than a machine, in accord with his dignity.
THE SIDEREAL MESSENGER

Galileo Galilei

Translation

EDWARD STAFFORD CARLOS, M.A.
THE
SIDEREAL MESSENGER

UNFOLDING GREAT AND MARVELLOUS SIGHTS, AND PROPOSING THEM TO THE ATTENTION OF EVERY ONE, BUT ESPECIALLY PHILOSOPHERS AND ASTRONOMERS,

BEING SUCH AS HAVE BEEN OBSERVED BY

GALILEO GALILEI

A GENTLEMAN OF FLORENCE,
PROFESSOR OF MATHEMATICS
IN THE UNIVERSITY OF PADUA,

WITH THE AID OF A
TELESCOPE
LATELY INVENTED BY HIM,

Respecting the Moon’s Surface, an innumerable number of Fixed Stars, the Milky Way, and Nebulous Stars, but especially respecting Four Planets which revolve round the Planet Jupiter at different distances and in different periodic times, with amazing velocity, and which, after remaining unknown to every one up to this day, the Author recently discovered, and determined to name the

MEDICEAN STARS.

VENICE 1610.
TO THE MOST SERENE
COSMO DE’ MEDICI, THE SECOND,
FOURTH GRAND-DUKE OF TUSCANY.

There is certainly something very noble and large-minded in the intention of those who have endeavoured to protect from envy the noble achievements of distinguished men, and to rescue their names, worthy of immortality, from oblivion and decay. This desire has given us the lineaments of famous men, sculptured in marble, or fashioned in bronze, as a memorial of them to future ages; to the same feeling we owe the erection of statues, both ordinary and equestrian; hence, as the poet\(^1\) says, has originated expenditure, mounting to the stars, upon columns and pyramids; with this desire, lastly, cities have been built, and distinguished by the names of those men, whom the gratitude of posterity thought worthy of being handed down to all ages. For the state of the human mind is such, that unless it be continually stirred by the counterparts\(^2\) of matters, obtruding themselves upon it from without, all recollection of the matters easily passes away from it.

But others, having regard for more stable and more lasting monuments, secured the eternity of the fame of great men by placing it under the protection, not of marble or bronze, but of the Muses’ guardianship and the imperishable monuments of literature. But why do I mention these things, as if human wit, content with these regions,

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1 Propertius, iii. 2. 17–22.
2 Compare Lucretius iv. 881:
Dico animo nostro primum simulacra meandi
Accidere, atque animum pulsare.
did not dare to advance further; whereas, since she well understood
that all human monuments do perish at last by violence, by weather,
or by age, she took a wider view, and invented more imperishable
signs, over which destroying Time and envious Age could claim no
rights; so, betaking herself to the sky, she inscribed on the well-
known orbs of the brightest stars—those everlasting orbs—the names
of those who, for eminent and god-like deeds, were accounted worthy
to enjoy an eternity in company with the stars. Wherefore the fame of
Jupiter, Mars, Mercury, Hercules, and the rest of the heroes by whose
names the stars are called, will not fade until the extinction of the
splendour of the constellations themselves.

But this invention of human shrewdness, so particularly noble
and admirable, has gone out of date ages ago, inasmuch as primeval
heroes are in possession of those bright abodes, and keep them by
a sort of right; into whose company the affection of Augustus in
vain attempted to introduce Julius Cæsar; for when he wished that
the name of the Julian constellation should be given to a star, which
appeared in his time, one of those which the Greeks and the Latins
alike name, from their hair-like tails, comets, it vanished in a short
time and mocked his too eager hope. But we are able to read the heav-
ens for your highness, most Serene Prince, far more truly and more
happily, for scarcely have the immortal graces of your mind begun to
shine on earth, when bright stars present themselves in the heavens,
like tongues to tell and celebrate your most surpassing virtues to all
time. Behold therefore, four stars reserved for your famous name,
and those not belonging to the common and less conspicuous multi-
tude of fixed stars, but in the bright ranks of the planets—four stars
which, moving differently from each other, round the planet Jupiter,
the most glorious of all the planets, as if they were his own children,
accomplish the courses of their orbits with marvellous velocity, while
all the while with one accord they complete all together mighty rev-
olutions every ten years round the centre of the universe, that is,
round the Sun.

But the Maker of the Stars himself seemed to direct me by clear
reasons to assign these new planets to the famous name of your high-
ness in preference to all others. For just as these stars, like children
worthy of their sire, never leave the side of Jupiter by any appreciable distance, so who does not know that clemency, kindness of heart, gentleness of manners, splendour of royal blood, nobleness in public functions, wide extent of influence and power over others, all of which have fixed their common abode and seat in your highness,—who, I say, does not know that all these qualities, according to the providence of God, from whom all good things do come, emanate from the benign star of Jupiter? Jupiter, Jupiter, I maintain, at the instant of the birth of your highness having at length emerged from the turbid mists of the horizon, and being in possession of the middle quarter of the heavens, and illuminating the eastern angle, from his own royal house, from that exalted throne, looked out upon your most happy birth, and poured forth into a most pure atmosphere all the brightness of his majesty, in order that your tender body and your mind—though that was already adorned by God with still more splendid graces—might imbibe with your first breath the whole of that influence and power. But why should I use only plausible arguments when I can almost absolutely demonstrate my conclusion? It was the will of Almighty God that I should be judged by your most serene parents not unworthy to be employed in teaching your highness mathematics, which duty I discharged, during the four years just passed, at that time of the year when it is customary to take a relaxation from severer studies. Wherfore, since it evidently fell to my lot by God’s will, to serve your highness, and so to receive the rays of your surpassing clemency and beneficence in a position near your person, what wonder is it if you have so warmed my heart that it thinks about scarcely anything else day and night, but how I, who am indeed your subject not only by inclination, but also by my very birth and lineage, may be known to be most anxious for your glory, and most grateful to you? And so, inasmuch as under your patronage, most serene Cosmo, I have discovered these stars, which were unknown to all astronomers before me, I have, with very good right, determined to designate them with the most august name of your family. And as I was the first to investigate them, who can rightly blame me if I give them a name, and call them the Medicean Stars, hoping that as much consideration may accrue to these stars from this title, as other stars
have brought to other heroes? For not to speak of your most serene ancestors, to whose everlasting glory the monuments of all history bear witness, your virtue alone, most mighty sire, can confer on those stars an immortal name; for who can doubt that you will not only maintain and preserve the expectations, high though they be, about yourself, which you have aroused by the very happy beginning of your government, but that you will also far surpass them, so that when you have conquered others like yourself, you may still vie with yourself, and become day by day greater than yourself and your greatness?

Accept, then, most element Prince, this addition to the glory of your family, reserved by the stars for you; and may you enjoy for many years those good blessings, which are sent to you not so much from the stars as from God, the Maker and Governor of the stars.

Your Highness’s most devoted servant,

Galileo Galilei.

Padua, March 12, 1610.
The Sidereal Messenger

Containing and setting forth Observations lately made with the aid of a newly invented Telescope respecting the Moon’s Surface, the Milky Way, Nebulous Stars, an innumerable multitude of Fixed Stars, and also respecting Four Planets never before seen, which have been named
In the present small treatise I set forth some matters of great interest for all observers of natural phenomena to look at and consider. They are of great interest, I think, first, from their intrinsic excellence; secondly, from their absolute novelty; and lastly, also on account of the instrument by the aid of which they have been presented to my apprehension.

The number of the Fixed Stars which observers have been able to see without artificial powers of sight up to this day can be counted. It is therefore decidedly a great feat to add to their number, and to set distinctly before the eyes other stars in myriads, which have never been seen before, and which surpass the old, previously known, stars in number more than ten times.

Again, it is a most beautiful and delightful sight to behold the body of the Moon, which is distant from us nearly sixty semi-diameters\textsuperscript{2} of the Earth, as near as if it was at a distance of only two of the same measures; so that the diameter of this same Moon appears about thirty times larger, its surface about nine hundred times, and its solid mass nearly 27,000 times larger than when it is viewed only with the naked eye; and consequently any one may know with the certainty

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1 The satellites of Jupiter are often called “the Cosmian Stars” in honour of Cosmo de’ Medici, but elsewhere Galileo calls them “the Medicean Stars.” Kepler sometimes calls them “the Medicean Stars,” but more often “satellites.”

2 Galileo says, “per sex denas fere terrestres diametros a nobis remotum” by mistake for semi-diametros, and the same mistake occurs in p. 11.
that is due to the use of our senses, that the Moon certainly does not possess a smooth and polished surface, but one rough and uneven, and, just like the face of the Earth itself, is everywhere full of vast protuberances, deep chasms, and sinuosities.

Then to have got rid of disputes about the Galaxy or Milky Way, and to have made its nature clear to the very senses, not to say to the understanding, seems by no means a matter which ought to be considered of slight importance. In addition to this, to point out, as with one’s finger, the nature of those stars which every one of the astronomers up to this time has called nebulous, and to demonstrate that it is very different from what has hitherto been believed, will be pleasant, and very fine. But that which will excite the greatest astonishment by far, and which indeed especially moved me to call the attention of all astronomers and philosophers, is this, namely, that I have discovered four planets, neither known nor observed by any one of the astronomers before my time, which have their orbits round a certain bright star, one of those previously known, like Venus and Mercury round the Sun, and are sometimes in front of it, sometimes behind it, though they never depart from it beyond certain limits. All which facts were discovered and observed a few days ago by the help of a telescope devised by me, through God’s grace first enlightening my mind.

Perchance other discoveries still more excellent will be made from time to time by me or by other observers, with the assistance of a similar instrument, so I will first briefly record its shape and preparation, as well as the occasion of its being devised, and then I will give an account of the observations made by me.

About ten months ago a report reached my ears that a Dutchman had constructed a telescope, by the aid of which visible objects, although at a great distance from the eye of the observer, were seen distinctly as if near; and some proofs of its most wonderful performances were reported, which some gave credence to, but others contradicted. A few days after, I received confirmation of the report

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3 The words used by Galileo for “telescope” are perspicillum, specillum instrumentum, organum, and occhiale (Ital.). Kepler uses also oculare tubus, arundo dioptrica. The word “telescopium” is used by Gassendi, 1647.
in a letter written from Paris by a noble Frenchman, Jaques Badovere, which finally determined me to give myself up first to inquire into the principle of the telescope, and then to consider the means by which I might compass the invention of a similar instrument, which a little while after I succeeded in doing, through deep study of the theory of Refraction; and I prepared a tube, at first of lead, in the ends of which I fitted two glass lenses, both plane on one side, but on the other side one spherically convex, and the other concave. Then bringing my eye to the concave lens I saw objects satisfactorily large and near, for they appeared one-third of the distance off and nine times larger than when they are seen with the natural eye alone. I shortly afterwards constructed another telescope with more nicety, which magnified objects more than sixty times. At length, by sparing neither labour nor expense, I succeeded in constructing for myself an instrument so superior that objects seen through it appear magnified nearly a thousand times, and more than thirty times nearer than if viewed by the natural powers of sight alone.

It would be altogether a waste of time to enumerate the number and importance of the benefits which this instrument may be expected to confer, when used by land or sea. But without paying attention to its use for terrestrial objects, I betook myself to observations of the heavenly bodies; and first of all, I viewed the Moon as near as if it was scarcely two semi-diameters of the Earth distant. After the Moon, I frequently observed other heavenly bodies, both fixed stars and planets, with incredible delight; and, when I saw their very great number, I began to consider about a method by which I might be able to measure their distances apart, and at length I found one. And here it is fitting that all who intend to turn their attention to observations of this kind should receive certain cautions. For, in the first place, it is absolutely necessary for them to prepare a most perfect telescope, one which will show very bright objects distinct and free from any mistiness, and will magnify them at least 400 times, for then it will show them as if

4 “Vix per duas Telluris diametros,” by mistake for “semi-diametros.”
only one-twentieth of their distance off. For unless the instrument be of such power, it will be in vain to attempt to view all the things which have been seen by me in the heavens, or which will be enumerated hereafter.

But in order that any one may be a little more certain about the magnifying power of his instrument, he shall fashion two circles, or two square pieces of paper, one of which is 400 times greater than the other, but that will be when the diameter of the greater is twenty times the length of the diameter of the other. Then he shall view from a distance simultaneously both surfaces, fixed on the same wall, the smaller with one eye applied to the telescope, and the larger with the other eye unassisted; for that may be done without inconvenience at one and the same instant with both eyes open. Then both figures will appear of the same size, if the instrument magnifies objects in the desired proportion.

After such an instrument has been prepared, the method of measuring distances remains for inquiry, and this we shall accomplish by the following contrivance:

For the sake of being more easily understood, I will suppose a tube $A B C D$. Let $e$ be the eye of the observer; then, when there are

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5 The line $c h$ in Galileo’s figure represents the small pencil of rays from $H$ which, after refraction through the telescope, reach the eye $e$. The enlarged figure shows that if $o p$ be the radius of the aperture employed, the point $H$ of the object would be just outside the field of view. The method, however, is at best only a very rough one, as the boundary of the field of view in this telescope is unavoidably indistinct.
no lenses in the tube rays from the eye to the object $F\ G$ would be
drawn in the straight lines $E\ C\ F$, $E\ D\ G$, but when the lenses have been
inserted, let the rays go in the bent lines $E\ C\ H$, $E\ D\ I$,—for they are
contracted, and those which originally, when unaffected by the lenses,
were directed to the object $F\ G$, will include only the part $H\ I$. Hence
the ratio of the distance $E\ H$ to the line $H\ I$ being known, we shall be
able to find, by means of a table of sines, the magnitude of the angle
subtended at the eye by the object $H\ I$, which we shall find to contain
only some minutes. But if we fit on the lens $C\ D$ thin plates of metal,
pierced, some with larger, others with smaller apertures, by putting
on over the lens sometimes one plate, sometimes another, as may be
necessary, we shall construct at our pleasure different subtending
angles of more or fewer minutes, by the help of which we shall be
able to measure conveniently the intervals between stars separated
by an angular distance of some minutes, within an error of one or
two minutes. But let it suffice for the present to have thus slightly
touched, and as it were just put our lips to these matters, for on
some other opportunity I will publish the theory of this instrument
in completeness.

Now let me review the observations made by me during the two
months just past, again inviting the attention of all who are eager for
ture philosophy to the beginnings which led to the sight of most
important phenomena.

Let me speak first of the surface of the
Moon, which is turned towards us. For the
sake of being understood more easily, I dis-
tinguish two parts in it, which I call
respectively the brighter and the darker. The brighter part seems to
surround and pervade the whole hemisphere ; but the darker part,
like a sort of cloud, discolours the Moon’s surface and makes it
appear covered with spots. Now these spots, as they are somewhat
dark and of considerable size, are plain to
every one, and every age has seen them,
wherefore I shall call them great or ancient
spots, to distinguish them from other spots,
smaller in size, but so thickly scattered that

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The Moon. Rugged-
ness of its surface.

Existence of lunar
mountains and
valleys.
they sprinkle the whole surface of the Moon, but especially the brighter portion of it. These spots have never been observed by any one before me; and from my observations of them, often repeated, I have been led to that opinion which I have expressed, namely, that I feel sure that the surface of the Moon is not perfectly smooth, free from inequalities and exactly spherical, as a large school of philosophers considers with regard to the Moon and the other heavenly bodies, but that, on the contrary, it is full of inequalities, uneven, full of hollows and protuberances, just like the surface of the Earth itself, which is varied everywhere by lofty mountains and deep valleys.

The appearances from which we may gather these conclusions are of the following nature:—On the fourth or fifth day after new-moon, when the Moon presents itself to us with bright horns, the boundary which divides the part in shadow from the enlightened part does not extend continuously in an ellipse, as would happen in the case of a perfectly spherical body, but it is marked out by an irregular, uneven, and very wavy line, as represented in the figure given, for several bright excrescences, as they may be called, extend beyond the boundary of light and shadow into the dark part, and on the other hand pieces of shadow encroach upon the light:—nay, even a great quantity of small blackish spots, altogether separated from the dark part, sprinkle everywhere almost the whole space which is at the time flooded with the Sun’s light, with the exception of that part alone which is occupied by the great and ancient spots. I have noticed that the small spots just mentioned have this common characteristic always and in every case, that they have the dark part towards the Sun’s position, and on the side away from the Sun they have brighter boundaries, as if they were crowned with shining summits. Now we have an appearance quite similar on the Earth about sunrise, when we behold the valleys, not yet flooded with light, but the mountains surrounding them on the side opposite to the Sun already ablaze with the splendour of his beams; and just as the shadows in the hollows of the Earth diminish in size as the Sun rises higher, so also these spots on the Moon lose their blackness as the illuminated part grows larger and larger. Again, not only are the
boundaries of light and shadow in the Moon seen to be uneven and sinuous, but—and this produces still greater astonishment—there appear very many bright points within the darkened portion of the Moon, altogether divided and broken off from the illuminated tract, and separated from it by no inconsiderable interval, which, after a little while, gradually increase in size and brightness, and after an hour or two become joined on to the rest of the bright portion, now become somewhat larger; but in the meantime others, one here and another there, shooting up as if growing, are lighted up within the shaded portion, increase in size, and at last are linked on to the same luminous surface, now still more extended. An example of this is given in the same figure. Now, is it not the case on the Earth before sunrise, that while the level plain is still in shadow, the peaks of the most lofty mountains are illuminated by the Sun’s rays? After a little while does not the light spread further, while the middle and larger parts of those mountains are becoming illuminated; and at length, when the Sun has risen, do not the illuminated parts of the plains and hills join together? The grandeur, however, of such prominences and depressions in the Moon seems to surpass both in magnitude and extent the ruggedness of the Earth’s surface, as I shall hereafter show. And here I cannot refrain from mentioning what a remarkable spectacle I observed while the Moon was rapidly approaching her first quarter, a representation of which is given in the same illustration, placed opposite page 16. A protuberance of the shadow, of great size, indented the illuminated part in the neighbourhood of the lower cusp; and when I had observed this indentation longer, and had seen that it was dark throughout, at length, after about two hours, a bright peak began to arise a little below the middle of the depression; this by degrees increased, and presented a triangular shape, but was as yet quite detached and separated from the illuminated surface. Soon around it three other small points began to shine, until, when the Moon was just about to set, that triangular figure, having now extended and widened, began to be connected with the rest of the illuminated part, and, still girt with the three bright peaks already mentioned, suddenly burst into the indentation of shadow like a vast promontory of light.
Sketches by Galileo to shew:—

The indentation of the terminator and illuminated summits of mountains in the dark part of the moon;

The shape of a lunar mountain and of a walled plain.

Galileo: 'Sidereus Nuncius', Venice 1610.
At the ends of the upper and lower cusps also certain bright points, quite away from the rest of the bright part, began to rise out of the shadow, as is seen depicted in the same illustration.

In both horns also, but especially in the lower one, there was a great quantity of dark spots, of which those which are nearer the boundary of light and shadow appear larger and darker, but those which are more remote less dark and more indistinct. In all cases, however, just as I have mentioned before, the dark portion of the spot faces the position of the Sun’s illumination, and a brighter edge surrounds the darkened spot on the side away from the Sun, and towards the region of the Moon in shadow. This part of the surface of the Moon, where it is marked with spots like a peacock’s tail with its azure eyes, is rendered like those glass vases which, through being plunged while still hot from the kiln into cold water, acquire a crackled and wavy surface, from which circumstance they are commonly called *frosted glasses.* Now the great spots of the Moon observed at the same time are not seen to be at all similarly broken, or full of depressions and prominences, but rather to be even and uniform; for only here and there some spaces, rather brighter than the rest, crop up; so that if any one wishes to revive the old opinion of the Pythagoreans, that the Moon is another Earth, so to say, the brighter portion may very fitly represent the surface of the land, and the darker the expanse of water. Indeed, I have never doubted that if the sphere of the Earth were seen from a distance, when flooded with the Sun’s rays, that part of the surface which is land would present itself to view as brighter, and that which is water as darker in comparison. Moreover, the great spots in the Moon are seen to be more depressed than the brighter tracts; for in the Moon, both when crescent and when waning, on the boundary between the light and shadow, which projects in some places round the great spots, the adjacent regions are always brighter, as I

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6 Specimens of *frosted or crackled Venetian glass* are to be seen in the Slade Collection, British Museum, and fully justify Galileo’s comparison.
have noticed in drawing my illustrations, and the edges of the spots referred to are not only more depressed than the brighter parts, but are more even, and are not broken by ridges or ruggednesses. But the brighter part stands out most near the spots, so that both before the first quarter and about the third quarter also, around a certain spot in the upper part of the figure, that is, occupying the northern region of the Moon, some vast prominences on the upper and lower sides of it rise to an enormous elevation, as the illustrations show. This same spot before the third quarter is seen to be walled round with boundaries of a deeper shade, which just like very lofty mountain summits appear darker on the side away from the Sun, and brighter on the side where they face the Sun; but in the case of the cavities the opposite happens, for the part of them away from the Sun appears brilliant, and that part which lies nearer to the Sun dark and in shadow. After a time, when the enlightened portion of the Moon’s surface has diminished in size, as soon as the whole or nearly so of the spot already mentioned is covered with shadow, the brighter ridges of the mountains mount high above the shade. These two appearances are shown in the illustrations which are given.

There is one other point which I must on no account forget, which I have noticed and rather wondered at. It is this:—The middle of the Moon\(^7\), as it seems, is occupied by a certain cavity larger than all the rest, and in shape perfectly round. I have looked at this depression near both the first and third quarters, and I have represented it as well as I can in the second illustration already given. It produces the same appearance as to effects of light and shade as a tract like Bohemia would produce on the Earth, if it were shut in on all sides by very lofty mountains arranged on the circumference of a perfect circle; for the tract in the Moon is walled in with peaks of such enormous height that the furthest side adjacent to the dark portion of the Moon is seen bathed in sunlight before the boundary between light and shade reaches half-way across

\[\text{Description of a lunar crater, perhaps Tycho.}\]

\(^7\) Webb, Celestial Objects for Common Telescopes, p. 104, suggests this identification.
the circular space. But according to the characteristic property of the rest of the spots, the shaded portion of this too faces the Sun, and the bright part is towards the dark side of the Moon, which for the third time I advise to be carefully noticed as a most solid proof of the ruggednesses and unevennesses spread over the whole of the bright region of the Moon. Of these spots, moreover, the darkest are always those which are near to the boundary-line between the light and the shadow, but those further off appear both smaller in size and less decidedly dark; so that at length, when the Moon at opposition becomes full, the darkness of the cavities differs from the brightness of the prominences with a subdued and very slight difference.

These phenomena which we have reviewed are observed in the bright tracts of the Moon. In the great spots we do not see such differences of depressions and prominences as we are compelled to recognise in the brighter parts, owing to the change of their shapes under different degrees of illumination by the Sun’s rays according to the manifold variety of the Sun’s position with regard to the Moon. Still, in the great spots there do exist some spaces rather less dark than the rest, as I have noted in the illustrations, but these spaces always have the same appearance, and the depth of their shadow is neither intensified nor diminished; they do appear indeed sometimes a little more shaded, sometimes a little less, but the change of colour is very slight, according as the Sun’s rays fall upon them more or less obliquely; and besides, they are joined to the adjacent parts of the spots with a very gradual connection, so that their boundaries mingle and melt into the surrounding region. But it is quite different with the spots which occupy the brighter parts of the Moon’s surface, for, just as if they were precipitous crags with numerous rugged and jagged peaks, they have well-defined boundaries through the sharp contrast of light and shade. Moreover, inside those great spots certain other tracts are seen brighter than the surrounding region, and some of them very bright indeed, but the appearance of these, as well as of the darker parts, is always the same; there is no change of shape or brightness or depth of shadow, so that it becomes
a matter of certainty and beyond doubt that their appearance is owing
to real dissimilarity of parts, and not to unevennesses only in their
configuration, changing in different ways the shadows of the same
parts according to the variations of their illumination by the Sun,
which really happens in the case of the other smaller spots occupying
the brighter portion of the Moon, for day by day they change, increase,
decrease, or disappear, inasmuch as they derive their origin only from
the shadows of prominences.

But here I feel that some people
may be troubled with grave doubt,
and perhaps seized with a difficulty
so serious as to compel them to feel
uncertain about the conclusion just
explained and supported by so many
phenomena. For if that part of the
Moon’s surface which reflects the Sun’s rays most brightly is full of
sinuosities, protuberances, and cavities innumerable, why, when the
Moon is increasing, does the outer edge which looks toward the west,
when the Moon is waning, the other half-circumference towards the
east, and at full-moon the whole circle, appear not uneven, rugged,
and irregular, but perfectly round and circular, as sharply defined as
if marked out with a pair of compasses, and without the indentations
of any protuberances or cavities? And most remarkably so, because
the whole unbroken edge belongs to that part of the Moon’s surface
which possesses the property of appearing brighter than the rest,
which I have said to be throughout full of protuberances and cavities.
For not one of the Great Spots extends quite to the circumference,
but all of them are seen to be together away from the edge. Of this
phenomenon, which affords a handle for such serious doubt, I pro-
duce two causes, and so two solutions of the difficulty.

The first solution which I offer is this:—If the protuberances and
cavities in the body of the Moon existed only on the edge of the circle
that bounds the hemisphere which we see, then the Moon might, or
rather must, show itself to us with the appearance of a toothed wheel,
being bounded with an irregular and uneven circumference; but
if, instead of a single set of prominences arranged along the actual

Explanation of the evenness
of the illuminated part of the
circumference of the Moon’s
orb by the analogy of terres-
trial phenomena, or by a
possible lunar atmosphere.
circumference only, very many ranges of mountains with their cavities and ruggednesses are set one behind the other along the extreme edge of the Moon, and that too not only in the hemisphere which we see, but also in that which is turned away from us, but still near the boundary of the hemisphere, then the eye, viewing them afar off, will not at all be able to detect the differences of prominences and cavities, for the intervals between the mountains situated in the same circle, or in the same chain, are hidden by the jutting forward of other prominences situated in other ranges, and especially if the eye of the observer is placed in the same line with the tops of the prominences mentioned. So on the Earth, the summits of a number of mountains close together appear situated in one plane, if the spectator is a long way off and standing at the same elevation. So when the sea is rough, the tops of the waves seem to form one plane, although between the billows there is many a gulf and chasm, so deep that not only the hulls, but even the bulwarks, masts, and sails of stately ships are hidden amongst them. Therefore, as within the Moon, as well as round her circumference, there is a manifold arrangement of prominences and cavities, and the eye, regarding them from a great distance, is placed in nearly the same plane with their summits, no one need think it strange that they present themselves to the visual ray which just grazes them as an unbroken line quite free from unevennesses. To this explanation may be added another, namely, that there is round the body of the Moon, just as round the Earth, an envelope of some substance denser than the rest of the ether, which is sufficient to receive and reflect the Sun’s rays, although it does not possess so much opacity as to be able to prevent our seeing through it—especially when it is not illuminated. That envelope, when illuminated by the Sun’s rays, renders the body of the Moon apparently larger than it really is, and would be able to stop our sight from penetrating to the solid body of the Moon, if its thickness were greater; now, it is of greater thickness about the circumference of the Moon, greater, I mean, not in actual thickness, but with reference to our sight-rays, which cut it obliquely; and so it may stop our vision, especially when it is in a state of brightness, and may conceal the true circumference of the Moon on the side towards the Sun.
This may be understood more clearly from the adjoining figure, in which the body of the Moon, \( A B C \), is surrounded by an enveloping atmosphere, \( D E G \). An eye at \( F \) penetrates to the middle parts of the Moon, as at \( A \), through a thickness, \( DA \), of the atmosphere; but towards the extreme parts a mass of atmosphere of greater depth, \( EB \), shuts out its boundary from our sight. An argument in favour of this is, that the illuminated portion of the Moon appears of larger circumference than the rest of the orb which is in shadow.

Perhaps also some will think that this same cause affords a very reasonable explanation why the greater spots on the Moon are not seen to reach to the edge of the circumference on any side, although it might be expected that some would be found about the edge as well as elsewhere; and it seems credible that there are spots there, but that they cannot be seen because they are hidden by a mass of atmosphere too thick and too bright for the sight to penetrate.

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*Calculation to show that the height of some lunar mountains exceeds four Italian miles (22,000 British feet).*

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8 In the list of the heights of lunar mountains determined by Beer and Maedler, given in their work Der Mond (Berlin, 1837), there are six which exceed 3000 toises, or 19,000 British feet.
I think that it has been sufficiently made clear, from the explanation of phenomena which have been given, that the brighter part of the Moon’s surface is dotted everywhere with protuberances and cavities; it only remains for me to speak about their size, and to show that the ruggednesses of the Earth’s surface are far smaller than those of the Moon’s; smaller, I mean, absolutely, so to say, and not only smaller in proportion to the size of the orbs on which they are. And this is plainly shown thus:—As I often observed in various positions of the Moon with reference to the Sun, that some summits within the portion of the Moon in shadow appeared illumined, although at some distance from the boundary of the light (the terminator), by comparing their distance with the complete diameter of the Moon, I learnt that it sometimes exceeded the one-twentieth ($\frac{1}{20}$th) part of the diameter. Suppose the distance to be exactly $\frac{1}{20}$th part of the diameter, and let the diagram represent the Moon’s orb, of which $c\,a\,f$ is a great circle, $e$ its centre, and $c\,f$ a diameter, which consequently bears to the diameter of the Earth the ratio $2:7$; and since the diameter of the Earth, according to the most exact observations, contains 7000 Italian miles, $c\,f$ will be 2000, and $c\,e$ 1000, and the $\frac{1}{20}$th part of the whole, $c\,f$, 100 miles. Also let $c\,f$ be a diameter of the great circle which divides the bright part of the Moon from the dark part (for, owing to the very great distance of the Sun from the Moon this circle does not differ sensibly from a great one), and let the distance of $a$ from the point $c$ be $\frac{1}{20}$th part of that...
diameter; let the radius $E A$ be drawn, and let it be produced to cut the
tangent line $G C D$, which represents the ray that illumines the summit,
in the point $D$. Then the arc $CA$ or the straight line $CD$ will be 100 of
such units, as $CE$ contains 1000. The sum of the squares of $DC$, $CE$ is
therefore 1,010,000, and the square of $DE$ is equal to this; therefore
the whole $ED$ will be more than 1004; and $AD$ will be more than 4 of
such units, as $CE$ contained 1000. Therefore the height of $AD$ in the
Moon, which represents a summit reaching up to the Sun’s ray, $G C D$,
and separated from the extremity $C$ by the distance $CD$, is more than
4 Italian miles; but in the Earth there are no mountains which reach
to the perpendicular height even of one mile. We are therefore left to
conclude that it is clear that the prominences of the Moon are loftier
than those of the Earth.

I wish in this place to assign the cause of another lunar phenomenon
well worthy of notice, and although this phenomenon was observed by
me not lately, but many years ago, and has been pointed out to some
of my intimate friends and pupils, explained, and assigned to its true
cause, yet as the observation of it is rendered easier and more vivid by
the help of a telescope, I have considered that it would not be unsuitably
introduced in this place, but I wish to introduce it chiefly in order that
the connection and resemblance between the Moon and the Earth may
appear more plainly.

When the Moon, both before and after conjunction, is found not
far from the Sun, not only does its orb show itself to our sight on the
side where it is furnished with shining horns, but a slight and faint
circumference is also seen to mark out the circle of the dark part, that
part, namely, which is turned away from the Sun, and to separate it
from the darker background of the sky. But if we examine the matter
more closely, we shall see that not only is the extreme edge of the part
in shadow shining with a faint brightness, but that the entire face of
the Moon, that side, that is, which does not feel the Sun’s glare, is
illuminated with a pale light of considerable brightness. At the first
glance only a fine circumference appears shining, on account of the
darker part of the sky adjacent to it; whereas, on the contrary, the
rest of the surface appears dark, on account of the contiguity of the
shining horns, which destroys the clearness of our sight. But if any
one chooses such a position for himself, that by the interposition of a roof, or a chimney, or some other object between his sight and the Moon, but at a considerable distance from his eye, the shining horns are hidden, and the rest of the Moon’s orb is left exposed to his view, then he will find that this tract of the Moon also, although deprived of sunlight, gleams with considerable light, and particularly so if the gloom of the night has already deepened through the absence of the Sun; for with a darker background the same light appears brighter. Moreover, it is found that this secondary brightness of the Moon, as I may call it, is greater in proportion as the Moon is less distant from the Sun; for it abates more and more in proportion to the Moon’s distance from that body, so much so that after the first quarter, and before the end of the second, it is found to be weak and very faint, although it be observed in a darker sky; whereas, at an angular distance of 60° or less, even during twilight, it is wonderfully bright, so bright indeed that, with the help of a good telescope, the great spots may be distinguished in it.

This strange brightness has afforded no small perplexity to philosophical minds; and some have published one thing, some another, as the cause to be alleged for it. Some have said that it is the inherent and natural brightness of the Moon; some that it is imparted to that body by the planet Venus; or, as others maintain, by all the stars; while some have said that it comes from the Sun, whose rays, they say, find a way through the solid mass of the Moon. But statements of this kind are disproved without much difficulty, and convincingly demonstrated to be false. For if this kind of light were the Moon’s own, or were contributed by the stars, the Moon would retain it, particularly in eclipses, and would show it then, when left in an unusually dark sky, but this is contrary to experience. For the brightness which is seen on the Moon in eclipses is far less intense, being somewhat reddish, and almost copper-coloured, whereas this is brighter and whiter; besides, the brightness seen during an eclipse is changeable and shifting, for it wanders over the face of the Moon, so that that part which is near the circumference of the circle of shadow thrown by the Earth is bright, but the rest of the Moon is always seen to be dark. From which circumstance we understand without hesitation that this brightness is
due to the proximity of the Sun’s rays coming into contact with some denser region which surrounds the Moon as an envelope; owing to which contact a sort of dawn-light is diffused over the neighbouring regions of the Moon, just as the twilight spreads in the morning and evening on the Earth; \(^9\) but I will treat more fully of this matter in my book upon the System of the Universe.\(^{10}\)

Again, to assert that this sort of light is imparted to the Moon by the planet Venus is so childish as to be undeserving of an answer; for who is so ignorant as not to understand that at conjunction and within an angular distance of 60° it is quite impossible for the part of the Moon turned away from the Sun to be seen by the planet Venus?

But that this light is derived from the Sun penetrating with its light the solid mass of the Moon, and rendering it luminous, is equally untenable. For then this light would never lessen, since the hemisphere of the Moon is always illumined by the Sun, except at the moment of a lunar eclipse, yet really it quickly decreases while the Moon is drawing near to the end of her first quarter, and when she has passed her first quarter it becomes quite dull. Since, therefore, this kind of secondary brightness is not inherent and the Moon’s own, nor borrowed from any of the stars, nor from the Sun, and since there now remains in the whole universe no other body whatever except the Earth, what, pray, must we conclude? What must we assert? Shall we assert that the body of the Moon, or some other dark

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9. The illumination of the Moon in eclipses, noticed by Galileo, is now referred to the refraction of the sunlight by the earth’s atmosphere, and the reddish colour of the light is explained by Herschel (Outlines of Astronomy, ch. vii.) to be due to the absorption of the violet and blue rays by the aqueous vapour of the Earth’s atmosphere. The idea of a sensible lunar atmosphere is not in accordance with the observed phenomena of the occultations of stars.

10. Galileo’s Systema Mundi. Owing to the violent opposition provoked by the discussion of the discoveries of Galileo, and their bearing on the Copernican system of astronomy, Galileo seems to have found it necessary to delay the publication of this work until 1632, when, believing himself safe under the friendship and patronage of Pope Urban VIII. and others in power at Rome, he at length published it. Urban, however, now turned against him, denounced the book and its author, and summoned him to Rome, where the well-known incidents of his trial and condemnation took place.
and sunless orb, receives light from the Earth? Why should it not be the Moon? And most certainly it is. The Earth, with fair and grateful exchange, pays back to the Moon an illumination like that which it receives from the Moon nearly the whole time during the darkest gloom of night. Let me explain the matter more clearly. At conjunction, when the Moon occupies a position between the Sun and the Earth, the Moon is illuminated by the Sun’s rays on her half towards the Sun which is turned away from the Earth, and the other half, with which she regards the Earth, is covered with darkness, and so in no degree illumines the Earth’s surface. When the Moon has slightly separated from the Sun, straightway she is partly illumined on the half directed towards us; she turns towards us a slender silvery crescent, and slightly illumines the Earth; the Sun’s illumination increases upon the Moon as she approaches her first quarter, and the reflexion of that light increases on the Earth; the brightness in the Moon next extends beyond the semicircle, and our nights grow brighter; at length the entire face of the Moon looking towards the Earth is irradiated with the most intense brightness by the Sun, which happens when the Sun and Moon are on opposite sides of the Earth; then far and wide the surface of the Earth shines with the flood of moonlight; after this the Moon, now waning, sends out less powerful beams, and the Earth is illumined less powerfully; at length the Moon draws near her first position of conjunction with the Sun, and forthwith black night invades the Earth. In such a cycle the moonlight gives us each month alternations of brighter and fainter illumination. But the benefit of her light to the Earth is balanced and repaid by the benefit of the light of the Earth to her; for while the Moon is found near the Sun about the time of conjunction, she has in front of her the entire surface of that hemisphere of the Earth which is exposed to the Sun, and vividly illumined with his beams, and so receives light reflected from the Earth. Owing to such reflexion, the hemisphere of the Moon nearer to us, though deprived of sunlight, appears of considerable brightness. Again, when removed from the Sun through a quadrant, the Moon sees only one-half of the Earth’s hemisphere illuminated, namely the western half, for the other, the eastern, is covered with the shades of night; the Moon is,
therefore, less brightly enlightened by the Earth, and accordingly that secondary light appears fainter to us. But if you imagine the Moon to be set on the opposite side of the Earth to the Sun, she will see the hemisphere of the Earth, now between the Moon and the Sun, quite dark, and steeped in the gloom of night; if, therefore, an eclipse should accompany such a position of the Moon, she will receive no light at all, being deprived of the illumination of the Sun and Earth together. In any other position, with regard to the Earth and the Sun, the Moon receives more or less light by reflexion from the Earth, according as she sees a greater or smaller portion of the hemisphere of the Earth illuminated by the Sun; for such a law is observed between these two orbs, that at whatever times the Earth is most brightly enlightened by the Moon, at those times, on the contrary, the Moon is least enlightened by the Earth; and contrariwise. Let these few words on this subject suffice in this place; for I will consider it more fully in my System of the Universe, where, by very many arguments and experimental proofs, there is shown to be a very strong reflexion of the Sun’s light from the Earth, for the benefit of those who urge that the Earth must be separated from the starry host, chiefly for the reason that it has neither motion nor light, for I will prove that the Earth has motion, and surpasses the Moon in brightness, and is not the place where the dull refuse of the universe has settled down; and I will support my demonstration by a thousand arguments taken from natural phenomena.

Hitherto I have spoken of the observations which I have made concerning the Moon’s body; now I will briefly announce the phenomena which have been, as yet, seen by me with reference to the Fixed Stars. And first of all the following fact is worthy of consideration:—The stars, fixed as well as erratic, when seen with a telescope, by no means appear to be increased in magnitude in the same proportion as other objects, and the Moon herself, gain increase of size; but in the case of the stars such increase appears much less, so that you may consider that a telescope, which (for the sake of illustration) is powerful enough to magnify other objects a hundred times, will scarcely render the stars magnified four

Stars. Their appearance in the telescope.
or five times. But the reason of this is as follows:—When stars are viewed with our natural eyesight they do not present themselves to us of their bare, real size, but beaming with a certain vividness, and fringed with sparkling rays, especially when the night is far advanced; and from this circumstance they appear much larger than they would if they were stripped of those adventitious fringes, for the angle which they subtend at the eye is determined not by the primary disc of the star, but by the brightness which so widely surrounds it. Perhaps you will understand this most clearly from the well-known circumstance that when stars rise just at sunset, in the beginning of twilight, they appear very small, although they may be stars of the first magnitude; and even the planet Venus itself, on any occasion when it may present itself to view in broad daylight, is so small to see that it scarcely seems to equal a star of the last magnitude. It is different in the case of other objects, and even of the Moon, which, whether viewed in the light of midday or in the depth of night, always appears of the same size. We conclude therefore that the stars are seen at midnight in uncurtailed glory, but their fringes are of such a nature that the daylight can cut them off, and not only daylight, but any slight cloud which may be interposed between a star and the eye of the observer. A dark veil or coloured glass has the same effect, for, upon placing them before the eye between it and the stars, all the blaze that surrounds them leaves them at once. A telescope also accomplishes the same result, for it removes from the stars their adventitious and accidental splendours before it enlarges their true discs (if indeed they are of that shape), and so they seem less magnified than other objects, for a star of the fifth or sixth magnitude seen through a telescope is shown as of the first magnitude only.

The difference between the appearance of the planets and the fixed stars seems also deserving of notice. The planets present their discs perfectly round, just as if described with a pair of compasses, and appear as so many little moons, completely illuminated and of a globular shape; but the fixed stars do not look to the naked eye bounded by a circular circumference, but rather like blazes of light, shooting out beams on all sides and very sparkling, and with a telescope they appear of the same shape as when they are viewed by simply looking
at them, but so much larger that a star of the fifth or sixth magnitude seems to equal Sirius, the largest of all the fixed stars.  

But beyond the stars of the sixth magnitude you will behold through the telescope a host of other stars, which escape the unassisted sight, so numerous as to be almost beyond belief, for you may see more than six other differences of magnitude, and the largest of these, which I may call stars of the seventh magnitude, or of the first magnitude of invisible stars, appear with the aid of the telescope larger and brighter than stars of the second magnitude seen with the unassisted sight. But in order that you may see one or two proofs of the inconceivable manner in which they are crowded together, I have determined to make out a case against two star-clusters, that from them as a specimen you may decide about the rest.

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**Telescopic Stars: their infinite multitude.** As examples, Orion’s Belt and Sword and the Pleiades are described as seen by Galileo.

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11 The immense distance of stars makes it impossible for them to be magnified by any telescope, however powerful; the apparent or spurious disc is an optical effect, which depends on the telescope used, and is smallest with the largest aperture.
As my first example I had determined to depict the entire constellation of Orion, but I was overwhelmed by the vast quantity of stars and by want of time, and so I have deferred attempting this to another occasion, for there are adjacent to, or scattered among, the old stars more than five hundred new stars within the limits of one or two degrees. For this reason I have selected the three stars in Orion’s Belt and the six in his Sword, which have been long well-known groups, and I have added eighty other stars recently discovered in their vicinity, and I have preserved as exactly as possible the intervals between them. The well-known or old stars, for the sake of distinction, I have depicted of larger size, and I have outlined them with a double line; the others, invisible to the naked eye, I have marked smaller and with one line only. I have also preserved the differences of magnitude as much as I could.

As a second example I have depicted the six stars of the constellation Taurus, called the Pleiades (I say six intentionally, since the seventh is scarcely ever visible), a group of stars which is enclosed in the heavens within very narrow precincts. Near these there lie more than forty others invisible to the naked eye, no one of which is much
more than half a degree off any of the aforesaid six; of these I have noticed only thirty-six in my diagram. I have preserved their intervals, magnitudes, and the distinction between the old and the new stars, just as in the case of the constellation Orion.

The next object which I have observed is the essence or substance of the Milky Way. By the aid of a telescope any one may behold this in a manner which so distinctly appeals to the senses that all the disputes which have tormented philosophers through so many ages are exploded at once by the irrefragable evidence of our eyes, and we are freed from wordy disputes upon this subject, for the Galaxy is nothing else but a mass of innumerable stars planted together in clusters. Upon whatever part of it you direct the telescope straightway a vast crowd of stars presents itself to view; many of them are tolerably large and extremely bright, but the number of small ones is quite beyond determination.

The Milky Way consists entirely of stars in countless numbers and of various magnitudes.
And whereas that milky brightness, like the brightness of a white cloud, is not only to be seen in the Milky Way, but several spots of a similar colour shine faintly here and there in the heavens, if you turn the telescope upon any of them you will find a cluster of stars packed close together. Further—and you will be more surprised at this,—the stars which have been called by every one of the astronomers up to this day nebulous, are groups of small stars set thick together in a wonderful way, and although each one of them on account of its smallness, or its immense distance from us, escapes our sight, from the commingling of their rays there arises that brightness which has hitherto been believed to be the denser part of the heavens, able to reflect the rays of the stars or the Sun.

I have observed some of these, and I wish to subjoin the star-clusters of two of these nebulae. First, you have a diagram of the nebula called that of Orion’s Head, in which I have counted twenty-one stars.

The second cluster contains the nebula called Præsepe, which is not one star only, but a mass of more than forty small stars. I have
noticed thirty-six stars, besides the Aselli, arranged in the order of the accompanying diagram.

I have now finished my brief account of the observations which I have thus far made with regard to the Moon, the Fixed Stars, and the Galaxy. There remains the matter, which seems to me to deserve to be considered the most important in this work, namely, that I should disclose and publish to the world the occasion of discovering and observing four planets, never seen from the very beginning of the world up to our own times, their positions, and the observations made during the last two months about their movements and their changes of magnitude; and I summon all astronomers to apply themselves to examine and determine their periodic times, which it has not been permitted me to achieve up to this day, owing to the restriction of my time. I give them warning however again, so that they may not approach such an inquiry to no purpose, that they will want a very accurate telescope, and such as I have described in the beginning of this account.

On the 7th day of January in the present year, 1610, in the first hour of the following night, when I was viewing the constellations of the heavens through a telescope, the planet Jupiter presented itself to my view, and as I had prepared for myself a very excellent instrument, I noticed a circumstance which I had never been able to notice before, owing to want of power in my other telescope, namely, that three little stars, small but very bright, were near the planet; and although I believed them to belong to the number of the fixed stars, yet they made me somewhat wonder, because they seemed to be arranged exactly in a straight line, parallel to the ecliptic,\textsuperscript{13} and to be brighter than the rest of the stars, equal to them in magnitude. The position

\textit{Discovery of Jupiter’s satellites, Jan. 7, 1610: record of Galileo’s observations during two months.}

\textsuperscript{12} The times of Galileo’s observations are to be understood as reckoned from sunset.

\textsuperscript{13} The satellites of Jupiter revolve in planes very nearly, although not exactly, coincident with that of the equator of the planet, which is inclined $3^\circ 5' 30''$ to the orbit of the planet, and the plane of the orbit is inclined $1^\circ 18' 51''$ to the ecliptic.
of them with reference to one another and to Jupiter was as follows (Fig. 1).

\[\text{JAN 7} \quad \cdots \quad \bigcirc \quad \cdots\]

*Figure 1.*

On the east side there were two stars, and a single one towards the west. The star which was furthest towards the east, and the western star, appeared rather larger than the third.

I scarcely troubled at all about the distance between them and Jupiter, for, as I have already said, at first I believed them to be fixed stars; but when on January 8th, led by some fatality, I turned again to look at the same part of the heavens, I found a very different state of things, for there were three little stars all west of Jupiter, and nearer together than on the previous night, and they were separated from one another by equal intervals, as the accompanying illustration (Fig. 2) shows.

\[\text{JAN 8} \quad \bigcirc \quad \cdots \quad \cdots\]

*Figure 2.*

At this point, although I had not turned my thoughts at all upon the approximation of the stars to one another, yet my surprise began to be excited, how Jupiter could one day be found to the east of all the aforesaid fixed stars when the day before it had been west of two of them; and forthwith I became afraid lest the planet might have moved differently from the calculation of astronomers, and so had passed those stars by its own proper motion. I therefore waited for the next night with the most intense longing, but I was disappointed of my hope, for the sky was covered with clouds in every direction.

But on January 10th the stars appeared in the following position with regard to Jupiter; there were two only, and both on the east side of Jupiter, the third, as I thought, being hidden by the planet (Fig. 3).

\[\text{JAN 10} \quad \cdots \quad \bigcirc\]

*Figure 3.*
They were situated just as before, exactly in the same straight line with Jupiter, and along the Zodiac.

When I had seen these phenomena, as I knew that corresponding changes of position could not by any means belong to Jupiter, and as, moreover, I perceived that the stars which I saw had been always the same, for there were no others either in front or behind, within a great distance, along the Zodiac,—at length, changing from doubt into surprise, I discovered that the interchange of position which I saw belonged not to Jupiter, but to the stars to which my attention had been drawn, and I thought therefore that they ought to be observed henceforward with more attention and precision.

Accordingly, on January 11th I saw an arrangement of the following kind (Fig. 4), namely, only two stars to the east of Jupiter, the nearer of which was distant from Jupiter three times as far as from the star further to the east; and the star furthest to the east was nearly twice as large as the other one; whereas on the previous night they had appeared nearly of equal magnitude. I therefore concluded, and decided unhesitatingly, that there are three stars in the heavens moving about Jupiter, as Venus and Mercury round the Sun; which at length was established as clear as daylight by numerous other subsequent observations. These observations also established that there are not only three, but four, erratic sidereal bodies performing their revolutions round Jupiter, observations of whose changes of position made with more exactness on succeeding nights the following account will supply. I have measured also the intervals between them with the telescope in the manner already explained. Besides this, I have given the times of observation, especially when several were made in the same night, for the revolutions of these planets are so swift that an observer may generally get differences of position every hour.

**JAN 11**

*Figure 4.*
Jan. 12.—At the first hour of the next night I saw these heavenly bodies arranged in this manner (Fig. 5).

\[
\text{JAN 12} \quad \cdot \quad \bigcirc \quad \cdot
\]

*Figure 5.*

The satellite\(^{14}\) furthest to the east was greater than the satellite furthest to the west; but both were very conspicuous and bright; the distance of each one from Jupiter was two minutes. A third satellite, certainly not in view before, began to appear at the third hour; it nearly touched Jupiter on the east side, and was exceedingly small. They were all arranged in the same straight line, along the ecliptic.

Jan. 13.—For the first time four satellites were in view in the following position with regard to Jupiter (Fig. 6).

\[
\text{JAN 13} \quad \cdot \quad \bigcirc \quad \cdot \quad \cdot \quad \cdot
\]

*Figure 6.*

There were three to the west, and one to the east; they made a straight line nearly, but the middle satellite of those to the west deviated a little from the straight line towards the north. The satellite furthest to the east was at a distance of 2' from Jupiter; there were intervals of 1' only between Jupiter and the nearest satellite, and between the satellites themselves, west of Jupiter. All the satellites appeared of the same size, and though small they were very brilliant, and far outshone the fixed stars of the same magnitude.

Jan. 14.—The weather was cloudy.

Jan. 15.—At the third hour of the night the four satellites were in the state depicted in the next diagram (Fig. 7) with reference to Jupiter.

\[
\text{JAN 15} \quad \bigcirc \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot
\]

*Figure 7.*

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\(^{14}\) Galileo continues to call these bodies *stars,* perhaps meaning "Medicean stars," throughout the description of their configurations, but as he had now detected their nature, it is more convenient to call them *satellites,* the term introduced by Kepler.
All were to the west, and arranged nearly in the same straight line; but the satellite which counted third from Jupiter was raised a little to the north. The nearest to Jupiter was the smallest of all; the rest appeared larger and in order of magnitude; the intervals between Jupiter and the three nearest satellites were all equal, and were of the magnitude of 2' each; but the satellite furthest to the west was distant 4' from the satellite nearest to it. They were very brilliant, and not at all twinkling, as they have always appeared both before and since. But at the seventh hour there were only three satellites, presenting with Jupiter an appearance of the following kind (Fig. 8).

**JAN 15**

![Figure 8](image)

They were, that is to say, in the same straight line to a hair; the nearest to Jupiter was very small, and distant from the planet 3'; the distance of the second from this one was 1'; and of the third from the second 4' 30". But after another hour the two middle satellites were still nearer, for they were only 30", or less, apart.

Jan. 16.—At the first hour of the night I saw three satellites arranged in this order (Fig. 9).

**JAN 16**

![Figure 9](image)

Jupiter was between two of them, which were at a distance of 0' 40" from the planet on either side, and the third was west of Jupiter at a distance of 8'. The satellites near to Jupiter appeared brighter than the satellite further off, but not larger.

Jan. 17, after sunset 0 hours 30 minutes, the configuration was of this kind (Fig. 10).

**JAN 17**

![Figure 10](image)
There was one satellite only to the east, at a distance of 3′ from Jupiter; to the west likewise there was only one satellite, distant 11′ from Jupiter. The satellite on the east appeared twice as large as the satellite to the west; and there were no more than these two. But four hours after, that is, nearly at the fifth hour, a third satellite began to emerge on the east side, which, before its appearance, as I think, had been joined with the former of the two other satellites, and the position was of this kind (Fig. 11).

\[ \text{JAN 17} \quad \cdot \quad \bigcirc \quad \cdot \]

*Figure 11.*

The middle satellite was very near indeed to the satellite on the east, and was only 20″ from it; and was a little towards the south of the straight line drawn through the two extreme satellites and Jupiter.

Jan. 18, at 0 h. 20 m. after sunset, the appearance was such as this (Fig. 12).

\[ \text{JAN 18} \quad \cdot \quad \bigcirc \quad \cdot \]

*Figure 12.*

The satellite to the east was larger than the western one, and was at a distance from Jupiter of 8′, the western one being at a distance of 10′.

Jan. 19.—At the second hour of the night the relative position of the satellites was such as this (Fig. 13); that is, there were three satellites exactly in a straight line with Jupiter, one to the east, at a distance of 6′ from Jupiter; between Jupiter and the first satellite to the west in order, there was an interval of 5′; this satellite was 4′ off the other one more to the west.

\[ \text{JAN 19} \quad \cdot \quad \bigcirc \quad \cdot \quad \cdot \]

*Figure 13.*

At that time I was doubtful whether or no there was a satellite between the satellite to the east and Jupiter, but so very close to Jupiter as almost to touch the planet; but at the fifth hour I saw this satellite distinctly, by that time occupying exactly the middle position between
Jupiter and the eastern satellite, so that the configuration was thus (Fig. 14). Moreover, the satellite which had just come into view was very small; yet at the sixth hour it was nearly as large as the rest.

**JAN 19**

![Figure 14.](image)

Jan. 20: 1 h. 15 m.—A similar arrangement was seen (Fig. 15). There were three satellites, so small as scarcely to be distinguishable; their distances from Jupiter, and from one another, were not more than 1'. I was doubtful whether on the western side there were two satellites or three.

**JAN 20**

![Figure 15.](image)

About the sixth hour they were grouped in this way (Fig. 16).

**JAN 20**

![Figure 16.](image)

The eastern satellite was twice as far away from Jupiter as before, that is 2'; on the western side, the satellite in the middle was distant from Jupiter 0' 40", and from the satellite still further to the west 0' 20"; at length, at the seventh hour, three satellites were seen on the western side (Fig. 17). The satellite nearest to Jupiter was distant from the planet 0' 20"; between this one and the satellite furthest to the west there was an interval of 40", but between these another satellite was in view slightly southward of them, and not more than 10" off the most westerly satellite.

**JAN 20**

![Figure 17.](image)

Jan. 21: 0 h. 30 m.—There were three satellites on the east side; the satellites and Jupiter were at equal distances apart (Fig. 18). The intervals were by estimation 50" each. There was also one satellite on
the west, distant 4′ from Jupiter. The satellite on the east side nearest to Jupiter was the least of all.

JAN 21

Figure 18.

Jan. 22: 2 h.—The grouping of the satellites was similar (Fig. 19). There was an interval of 5′ from the satellite on the east to Jupiter; from Jupiter to the satellite furthest to the west 7′. The two interior satellites on the western side were 0′ 40″ apart, and the satellite nearer to Jupiter was 1′ from the planet.

JAN 22

Figure 19.

The inner satellites were smaller than the outer ones, but they were situated all in the same straight line, along the ecliptic, except that the middle of the three western satellites was slightly to the south of it, but at the sixth hour of the night they appeared in this position (Fig. 20).

JAN 22

Figure 20.

The satellite on the east was very small, at a distance from Jupiter of 5′ as before; but the three satellites on the west were separated by equal distances from Jupiter and from each other; and the intervals were nearly 1′ 20″ each. The satellite nearest Jupiter appeared smaller than the other two on the same side, but they all appeared arranged exactly in the same straight line.

Jan. 23, at 0 h. 40 m. after sunset, the grouping of the satellites was nearly after this fashion (Fig. 21).

JAN 23

Figure 21.
There were three satellites with Jupiter in a straight line along the ecliptic, as they always have been; two were on the east of the planet, one on the west; the satellite furthest to the east was 7′ from the next one, and this satellite 2′ 40″ from Jupiter; Jupiter was 3′ 20″ from the satellite on the west; and they were all of nearly the same size.

But at the fifth hour the two satellites which had been previously near Jupiter were no longer visible, being, as I suppose, hidden behind Jupiter, and the appearance presented was such as this (Fig. 22).

Jan. 24.—Three satellites, all on the east side, were visible, and nearly, but not quite, in the same straight line with Jupiter, for the satellite in the middle was slightly to the south of it (Fig. 23).

The satellite nearest to Jupiter was 2′ distant from the planet; the next in order 0′ 30″ from this satellite, and the third was 9′ further off still; they were all very bright. But at the sixth hour two satellites only presented themselves to view in this position, namely in the same straight line with Jupiter exactly, and the distance of the nearest to the planet was lengthened to 3′; the next was 2′ further off, and unless I am mistaken, the two satellites previously observed in the middle had come together, and appeared as one.

Jan. 25, at 1 h. 40 m., the satellites were grouped thus (Fig. 24). There were only two satellites on the east side, and these were rather large. The satellite furthest to the east was 5′ from the satellite in the middle, and it was 6′ from Jupiter.
Jan. 26, at 0 h. 40 m., the relative positions of the satellites were thus (Fig. 25). Three satellites were in view, of which two were east and the third west of Jupiter; this one was distant 3′ from the planet. On the east side the satellite in the middle was at a distance of 5′ 20″; the further satellite was 6′ beyond; they were arranged in a straight line, and were of the same size.

**JAN 26**

![Figure 25.](image)

At the fifth hour the arrangement was nearly the same, with this difference only, that the fourth satellite was emerging on the east side near Jupiter. It was smaller than the rest, and was then at a distance of 0′ 30″ from Jupiter; but was raised a little above the straight line towards the north, as the accompanying figure shows (Fig. 26).

**JAN 26**

![Figure 26.](image)

Jan. 27, 1 h. after sunset, a single satellite only was in view, and that on the east side of Jupiter in this position (Fig. 27). It was very small, and at a distance of 7′ from Jupiter.

**JAN 27**

![Figure 27.](image)

Jan. 28 and 29.—Owing to the intervention of clouds, I could make no observation.

Jan. 30.—At the first hour of the night the satellites were in view, arranged in the following way (Fig. 28).

**JAN 30**

![Figure 28.](image)

There was one satellite on the east side, at a distance of 2′ 30″ from Jupiter; and there were two satellites on the west, of which the
one nearer to Jupiter was 3' off the planet, and the other satellite 1' further. The places of the outer satellites and Jupiter were in the same straight line; but the satellite in the middle was a little above it to the north. The satellite furthest to the west was smaller than the rest.

On the last day of the month, at the second hour, two satellites on the east side were visible, and one on the west (Fig. 29).

![Figure 29.](image)

Of the satellites east of the planet, the one in the middle was 2' 20" distant from Jupiter; and the satellite further to the east was 0' 30" from the middle satellite; the satellite on the west was at a distance of 10' from Jupiter.

They were in the same straight line nearly, and would have been exactly so, only the satellite on the east nearest to Jupiter was raised a little towards the north. At the fourth hour, the two satellites on the east were still nearer together, for they were only 20" apart (Fig. 30). The western satellite appeared rather small in these two observations.

![Figure 30.](image)

Feb. 1.—At the second hour of the night the arrangement was similar (Fig. 31). The satellite furthest to the east was at a distance of 6' from Jupiter, and the western satellite 8'. On the east side there was a very small satellite, at a distance of 20" from Jupiter. They made a perfectly straight line.

![Figure 31.](image)

Feb. 2.—The satellites were seen arranged thus (Fig. 32). There was one only on the east, at a distance of 6' from Jupiter. Jupiter was 4' from the nearest satellite on the west; between this satellite and the
satellite further to the west there was an interval of 8’; they were in the same straight line exactly, and were nearly of the same magnitude.

FEB 2

\[\text{Figure 32.}\]

But at the seventh hour four satellites were there —two on each side of Jupiter (Fig. 33). Of these satellites, the most easterly was at a distance of 4’ from the next; this satellite was 1’ 40” from Jupiter; Jupiter was 6’ from the nearest satellite on the west, and this one from the satellite further to the west, 8’; and they were all alike in the same straight line, drawn in the direction of the Zodiac.

FEB 2

\[\text{Figure 33.}\]

Feb. 3: 7 h.—The satellites were arranged in the following way (Fig. 34) :—The satellite on the east was at a distance of 1’ 30” from Jupiter; the nearest satellite on the west, 2’, and there was a long distance, 10’, from this satellite to the satellite further to the west. They were exactly in the same straight line, and of equal magnitude.

FEB 3

\[\text{Figure 34.}\]

Feb. 4: 2 h.—Four satellites attended Jupiter, two on the east and two on the west, arranged in one perfectly straight line, as in the adjoining figure (Fig. 35). The satellite furthest to the east was at a distance of 3’ from the next satellite. This one was 0’ 40” from Jupiter; Jupiter 4’ from the nearest satellite on the west; and this one from the satellite further to the west 6’. In magnitude they were nearly equal; the satellite nearest to Jupiter was rather smaller in appearance than the rest.

FEB 4

\[\text{Figure 35.}\]
But at the seventh hour (Fig. 36) the eastern satellites were at a distance of only $0' 30''$ apart. Jupiter was $2'$ from the nearest satellite on the east; and from the satellite on the west, next in order, $4'$; this one was distant $3'$ from the satellite further to the west. They were all equal in magnitude, and in a straight line, drawn in the direction of the ecliptic.

![Figure 36](image)

Feb. 5.—The sky was cloudy.

Feb. 6.—Two satellites only appeared, with Jupiter between them, as is seen in the accompanying figure (Fig. 37). The satellite on the east was $2'$ from Jupiter, and that on the west $3'$. They were in the same straight line with Jupiter, and were equal in magnitude.

![Figure 37](image)

Feb. 7.—There were two satellites by the side of Jupiter, and both of them on the east of the planet, arranged in this manner (Fig. 38). The intervals between the satellites and Jupiter were equal, and of $1'$ each; and a straight line would go through them and the centre of Jupiter.

![Figure 38](image)

Feb. 8 : 1 h.—Three satellites were there, all on the east side of Jupiter, as in the diagram (Fig. 39).

![Figure 39](image)

The nearest to Jupiter, a rather small one, was distant from the planet $1' 20''$; the middle one was $4'$ from this satellite, and was rather large; the satellite furthest to the east, a very small one, was at a distance of $0' 20''$ from this satellite. It was doubtful whether there was one
satellite near to Jupiter or two, for sometimes it seemed that there was another satellite by its side towards the east, wonderfully small, and only 10" from it. They were all situated at points in a straight line drawn in the direction of the Zodiac. At the third hour the satellite nearest to Jupiter was almost touching the planet, for it was only distant 10" from it; but the others had become further off, for the middle one was 6' from Jupiter. At length, at the fourth hour, the satellite which was previously the nearest to Jupiter joined with the planet and disappeared.

Feb. 9 : 0h. 30m.—There were two satellites on the east side of Jupiter, and one on the west, in an arrangement such as this (Fig. 40). The satellite furthest to the east, which was a rather small one, was distant 4' from the next satellite; the satellite in the middle was larger, and at a distance of 7' from Jupiter. Jupiter was distant 4' from the western satellite, which was a small one.

\[ \text{FEB 9} \quad \cdot \quad \cdot \quad \bigcirc \quad \cdot \]

*Figure 40.*

Feb. 10 : 1h. 30 m.—A pair of satellites, very small, and both on the east of the planet, were visible, in the following position (Fig. 41).

\[ \text{FEB 10} \quad \cdot \quad \cdot \quad \bigcirc \]

*Figure 41.*

The further satellite was distant from Jupiter 10', the nearer 0' 20", and they were in the same straight line; but at the fourth hour the satellite nearest to Jupiter no longer appeared, and the other seemed so diminished that it could scarcely be kept in sight, although the atmosphere was quite clear, and the satellite was further from Jupiter than before, since its distance was now 12'.

Feb. 11 : 1 h.—There were two satellites on the east, and one on the west (Fig. 42). The western satellite was at a distance of 4' from Jupiter.

\[ \text{FEB 11} \quad \cdot \quad \cdot \quad \bigcirc \quad \cdot \]

*Figure 42.*
The satellite on the east, nearest to the planet, was likewise 4′ from Jupiter; but the satellite further to the east was at a distance from this one of 8′; they were fairly clear to view, and in the same straight line; but at the third hour the fourth satellite was visible near to Jupiter on the east, less in magnitude than the rest, separated from Jupiter by a distance of 0′ 30″, and slightly to the north out of the straight line drawn through the rest (Fig. 43).

![Figure 43.](image)

They were all very bright and extremely distinct, but at 5 h. 30 m. the satellite on the east nearest to Jupiter had moved further away from the planet, and was occupying a position midway between the planet and the neighbouring satellite further to the east. They were all in the same straight line exactly, and of the same magnitude, as may be seen in the accompanying diagram (Fig. 44).

![Figure 44.](image)

Feb. 12: 0 h. 40 m.—A pair of satellites on the east, a pair likewise on the west, were near the planet (Fig. 45).

The satellite on the east furthest removed from Jupiter was at a distance of 10′, and the further of the satellites on the west was 8′ off. They were both fairly distinct. The other two were very near to Jupiter, and very small, especially the satellite to the east, which was at a distance of 0′ 40″ from Jupiter. The distance of the western satellite was 1′. But at the fourth hour the satellite which was nearest to Jupiter on the east was visible no longer.

![Figure 45.](image)

Feb. 13: 0 h. 30 m.—Two satellites were visible in the east, two also in the west (Fig. 46). The satellite on the east near Jupiter was fairly
distinct; its distance from the planet was 2′. The satellite further to the east was less noticeable; it was distant 4′ from the other. Of the satellites on the west, the one furthest from Jupiter, which was very distinct, was parted from the planet 4′. Between this satellite and Jupiter intervened a small satellite close to the most westerly satellite, being not more than 0′ 3″ off. They were all in the same straight line, corresponding exactly to the direction of the ecliptic.

![Figure 46.]

Feb. 15 (for on the 14th the sky was covered with clouds), at the first hour, the position of the satellites was thus (Fig. 47); that is, there were three satellites on the east, but none were visible on the west.

![Figure 47.]

The satellite on the east nearest to Jupiter was at a distance of 0′ 50″ from the planet; the next in order was 0′ 20″ from this satellite, and the furthest to the east was 2′ from the second satellite, and it was larger than the others, for those nearer to Jupiter were very small. But about the fifth hour only one of the satellites which had been near to Jupiter was to be seen; its distance from Jupiter was 0′ 30″. The distance of the satellite furthest to the east from Jupiter had increased, for it was then 4′ (Fig. 48).

![Figure 48.]

But at the sixth hour, besides the two situated as just described on the east, one satellite was visible towards the west, very small, at a distance of 2′ from Jupiter (Fig. 49).

![Figure 49.]

59
Feb. 16: 6 h.—Their places were arranged as follows (Fig. 50); that is, the satellite on the east was 7′ from Jupiter, Jupiter 5′ from the next satellite on the west, and this 3′ from the remaining satellite still further to the west. They were all of the same magnitude nearly, rather bright, and in the same straight line, corresponding accurately to the direction of the Zodiac.

![Figure 50.]

Feb. 17: 1 h.—Two satellites were in view, one on the east, distant 3′ from Jupiter; the other on the west, distant 10′ (Fig. 51). The latter was somewhat less than the satellite on the east; but at the sixth hour the eastern satellite was nearer to Jupiter, being at a distance of 0′ 50″, and the western satellite was further off, namely 12′. At both observations they were in the same straight line with Jupiter, and were both rather small, especially the eastern satellite in the second observation.

![Figure 51.]

Feb. 18: 1 h.—Three satellites were in view, of which two were on the west and one on the east; the distance of the eastern satellite from Jupiter was 3′, and of the nearest satellite on the west 2′; the remaining satellite, still further to the west, was 8′ from the middle satellite (Fig. 52).

![Figure 52.]

They were all in the same straight line exactly, and of about the same magnitude. But at the second hour the satellites nearest to the planet were at equal distances from Jupiter, for the western satellite was now also 3′ from the planet. But at the sixth hour the fourth
satellite was visible between the satellite on the east and Jupiter, in the following configuration (Fig. 53).

FEB 18

\[ \begin{array}{cccc}
\cdot & \cdot & \bigcirc & \cdot & \cdot
\end{array} \]

Figure 53.

The satellite furthest to the east was at a distance of 3′ from the next in order; this one was at a distance of 1′ 50″ from Jupiter; Jupiter was at a distance of 3′ from the next satellite on the west, and this 7′ from the satellite still further to the west. These were nearly equal in magnitude, only the satellite on the east nearest to Jupiter was a little smaller than the rest, and they were all in the same straight line parallel to the ecliptic.

Feb. 19 : 0 h. 40 m.—Two satellites only were in view, west of Jupiter, rather large, and arranged exactly in the same straight line with Jupiter, in the direction of the ecliptic (Fig. 54). The nearer satellite was at a distance of 7′ from Jupiter and of 6′ from the satellite further to the west.

FEB 19

\[ \begin{array}{ccc}
\bigcirc & \cdot & \cdot
\end{array} \]

Figure 54.

Feb. 20.—The sky was cloudy.

Feb. 21 : 1 h. 30 m.—Three satellites, rather small, were in view, placed thus (Fig. 55). The satellite to the east was 2′ from Jupiter; Jupiter was 3′ from the next, which was on the west; and this one was 7′ from the satellite further to the west. They were exactly in the same straight line parallel to the ecliptic.

FEB 21

\[ \begin{array}{cccc}
\cdot & \bigcirc & \cdot & \cdot
\end{array} \]

Figure 55.

Feb. 25 : 1 h. 30 m. (for on the three previous nights the sky was overcast).—Three satellites appeared, two on the east, which were at a distance of 4′ apart, the same as the distance of the nearer satellite from Jupiter; on the west there was one satellite at a distance of 2′
from Jupiter. They were exactly in the same straight line in the direction of the ecliptic (Fig. 56).

FEB 25

Figure 56.

Feb. 26: 0 h. 30 m.—A pair of satellites only were present, one on the east, distant 10′ from Jupiter; the other was on the west, at a distance of 6′ (Fig. 57).

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Figure 57.

The eastern satellite was slightly smaller than the western. At the fifth hour three satellites were visible; for, besides the two already noticed, a third satellite was in view, on the west, near Jupiter, very small, which previously had been hidden behind Jupiter, and it was at a distance of 1′ from the planet (Fig. 58).

26

Figure 58.

But the satellite on the east was seen to be further off than before, being at a distance of 11′ from Jupiter. On this night, for the first time, I determined to observe the motion of Jupiter and the adjacent planets (his satellites) along the zodiac, by reference to some fixed star; for there was a fixed star in view, eastwards of Jupiter, at a distance of 11′ from the satellite on the east, and a little to the south, in the following manner (Fig. 59).

FEB 26

Figure 59.
Feb. 27: 1 h. 4 m.—The satellites appeared in the following configuration. The satellite furthest to the east was at a distance of 10′ from Jupiter; the next in order was near Jupiter, being at a distance of 0′ 30″ from the planet. The next satellite was on the western side, at a distance of 2′ 30″ from Jupiter; and the satellite further to the west was at a distance of 1′ from this. The two satellites near to Jupiter appeared small, especially the satellite on the east; but the satellites furthest off were very bright, particularly that on the west, and they made a straight line in the direction of the ecliptic exactly. The motion of the planets towards the east was plainly seen by reference to the aforesaid fixed star, for Jupiter and his attendant satellites were nearer to it, as may be seen in the accompanying figure (Fig. 60). At the fifth hour the satellite on the east, near to Jupiter, was 1′ from the planet.

![Figure 60](image1)

Feb. 28: 1 h.—Only two satellites were visible, one on the east, at a distance of 9′ from Jupiter, and another on the west, at a distance of 2′; they were both rather bright, and in the same straight line with Jupiter, and a straight line drawn from the fixed star perpendicular to this straight line fell upon the satellite on the east, as in the figure (Fig. 61).

![Figure 61](image2)

At the fifth hour a third satellite was seen at a distance of 2′ from Jupiter, on the east, in the position shown in the figure (Fig. 62).

![Figure 62](image3)
March 1: 0 h. 40 m.—Four satellites, all on the east of the planet, were seen; the satellite nearest to Jupiter was 2′ from the planet; the next 1′ from this; the third was 0′ 20″ from the second, and was brighter than the others; and the satellite still further to the east was at a distance of 4′ from it, and was smaller than the others (Fig. 63). They made a straight line very nearly, only the satellite third from Jupiter was slightly above the line. The fixed star formed with Jupiter and the most easterly satellite an equilateral triangle, as in the figure.

**Figure 63.**

March 2: 0 h. 40 m.—Three satellites were in attendance, two on the east and one on the west, in the configuration shown in the diagram (Fig. 64). The satellite furthest to the east was 7′ from Jupiter; from this satellite the next was distant 0′ 30″, and the satellite on the west was separated from Jupiter by an interval of 2′. The satellites furthest off were brighter and larger than the remaining satellite, which appeared very small. The satellite furthest to the east seemed to be raised a little towards the north, out of the straight line drawn through the other satellites and Jupiter.

**Figure 64.**

The fixed star already noticed was at a distance of 8′ from the western satellite, that is, from the perpendicular drawn from that satellite to the straight line drawn through all the system, as shown in the figure given.

These determinations of the motion of Jupiter and the adjacent planets (his satellites) by reference to a fixed star, I have thought well to present to the notice of astronomers, in order that any one may be able to understand from them that the movements of these planets (Jupiter’s satellites) both in longitude and in latitude agree exactly with the motions [of Jupiter] which are extracted from tables.
These are my observations upon the four Medicean planets, recently discovered for the first time by me; and although it is not yet permitted me to deduce by calculation from these observations the orbits of these bodies, yet I may be allowed to make some statements, based upon them, well worthy of attention.

And, in the first place, since they are sometimes behind, sometimes before Jupiter, at like distances, and withdraw from this planet towards the east and towards the west only within very narrow limits of divergence, and since they accompany this planet alike when its motion is retrograde and direct, it can be a matter of doubt to no one that they perform their revolutions about this planet, while at the same time they all accomplish together orbits of twelve years’ length about the centre of the world. Moreover, they revolve in unequal circles, which is evidently the conclusion to be drawn from the fact that I have never been permitted to see two satellites in conjunction when their distance from Jupiter was great, whereas near Jupiter two, three, and sometimes all (four), have been found closely packed together. Moreover, it may be detected that the revolutions of the satellites which describe the smallest circles round Jupiter are the most rapid, for the satellites nearest to Jupiter are often to be seen in the east, when the day before they have appeared in the west, and contrariwise. Also the satellite moving in the greatest orbit seems to me, after carefully weighing the occasions of its returning to positions previously noticed, to have a periodic time of half a month. Besides, we have a notable and

Deductions from the previous observations concerning the orbits and periods of Jupiter’s satellites.

15 In the edition of Galileo’s works published at Florence, 1854, there are given the tables of the hourly movements of the satellites of Jupiter, from which Galileo determined their periods of revolution. In the beginning of his treatise on floating bodies, Discorso intorno i Galleggianti, 1611-12, Galileo gives the times of rotation as approximately, (i.) 1 d. 18½ h.; (ii.) 3 d. 13½ h.; (iii.) 7 d. 4 h.; (iv.) 16 d. 18 h.; be also published configurations of the satellites calculated for March, April, and a part of May 1613. The periodic times of the satellites, as corrected by later observers, are, (i.) 1 d. 18 h. 28 m.; (ii.) 3 d. 13 h. 15 m.; (iii.) 7 d. 3 h. 43 m.; (iv.) 16 d. 16 h. 32 m.
splendid argument to remove the scruples of those who can tolerate the revolution of the planets round the Sun in the Copernican system, yet are so disturbed by the motion of one Moon about the Earth, while both accomplish an orbit of a year’s length about the Sun, that they consider that this theory of the constitution of the universe must be upset as impossible; for now we have not one planet only revolving about another, while both traverse a vast orbit about the Sun, but our sense of sight presents to us four satellites circling about Jupiter, like the Moon about the Earth, while the whole system travels over a mighty orbit about the Sun in the space of twelve years.

Lastly, I must not pass over the consideration of the reason why it happens that the Medicean stars, in performing very small revolutions about Jupiter, seem sometimes more than twice as large as at other times. We can by no means look for the explanation in the mists of the Earth’s atmosphere, for they appear increased or diminished, while the discs of Jupiter and neighbouring fixed stars are seen quite unaltered. That they approach and recede from the Earth at the points of their revolutions nearest to and furthest from the Earth to such an extent as to account for so great changes seems altogether untenable, for a strict circular motion can by no means show those phenomena; and an elliptical motion (which in this case would be nearly rectilinear) seems to be both untenable and by no means in harmony with the phenomena observed. But I gladly publish the explanation which has occurred to me upon this subject, and submit it to the judgment and criticism of all true philosophers. It is certain that when atmospheric mists intervene the Sun and Moon appear larger, but the fixed stars and planets less than they really are; hence the former luminaries, when near the horizon, are larger than at other times, but stars appear smaller, and are frequently scarcely visible; also they are still more diminished if those mists are bathed in light; so stars appear very small by day and in the twilight, but the Moon does not appear so, as I have previously remarked. Moreover, it is certain that not only the Earth, but also the Moon, has its own
vaporous sphere enveloping it, for the reasons which I have previously mentioned, and especially for those which shall be stated more fully in my *System*; and we may consistently decide that the same is true with regard to the rest of the planets; so that it seems to be by no means an untenable opinion to place round Jupiter also an atmosphere denser than the rest of the ether,\textsuperscript{16} about which, like the Moon about the sphere of the elements, the Medicean planets (Jupiter’s satellites) revolve; and that by the intervention of this atmosphere they appear smaller when they are in apogee; but when in perigee, through the absence or attenuation of that atmosphere, they appear larger. Want of time prevents my going further into these matters; my readers may expect further remarks upon these subjects in a short time.

\textsuperscript{16} Modern astronomers agree in assigning an atmosphere to Jupiter, but consider it not extensive enough to affect the brightness of the satellites.—(Webb, *Celestial Objects for Common Telescopes*.) Their absolute magnitudes are different, and their surfaces have been observed to be obscured by spots, which may account for the variations of their brightness. These spots, like the lunar spots, are probably due to variations of reflective power at different parts of their surfaces, for as they always turn the same face to Jupiter, they present different portions of their surfaces to us periodically, and it has been ascertained by observation that “these fluctuations in their brightness are periodical, depending on their position with respect to the Sun.”—(Herschel, *Outlines of Astronomy*; Arago, *Astronomie Populaire*, 1854.)
Original Configurations of Jupiter’s Satellites observed by Galileo in the months of January, February, and March 1610, and published with the 1st edition of his book Sidereus Nuncius, Venice, 1610.

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* Moon, ⋄ Jupiter, ⋄ Star*
Letter to Benedetto Castelli

Translator: Unknown

Very Reverend Father and My Most Respectable Sir:

Yesterday Mr. Niccolò Arrighetti came to visit me and told me about you. Thus, I took infinite pleasure in hearing about what I did not doubt at all, namely about the great satisfaction you have been giving to the whole University. However, the seal of my pleasure was to hear him relate the arguments which through the great kindness of their Most Serene Highness, you had the occasion of advancing at their table and then of continuing in the chambers of the Most Serene Ladyship, in the presence also of the Grand Duke and the Most Serene Archduchess, the Most Illustrious and Excellent Don Antonio and Don Paolo Giordano, and some of the very excellent philosophers there. What greater fortune can you wish than to see their Highnesses themselves enjoying discussing with you, putting forth doubts, listening to your solutions, and finally remaining satisfied with your answers?

After Mr. Arrighetti related the details you had mentioned, they gave me the occasion to go back to examine some general questions about the use of the Holy Scripture in disputes involving physical conclusions and some particular other ones about Joshua’s passage, which was presented in opposition to the earth’s motion and sun’s stability by the Grand Duchess Dowager with some support by the Most Serene Archduchess.

In regard to the first general point of the Most Serene Ladyship, it seems to me very prudent of her to propose and of you to concede and to agree that the Holy Scripture can never lie or err, and that its
declarations are absolutely and inviolably true. I should have added only that, though the Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways. One of these would be very serious and very frequent, namely to want to limit oneself always to the literal meaning of the words; for there would thus emerge not only various contradictions but also serious heresies and blasphemies, and it would be necessary to attribute to God feet, hands and eyes, as well as bodily and human feelings like anger, regret, hate and sometimes even forgetfulness of things past and ignorance of future ones. Thus in the Scripture one finds many propositions which look different from the truth if one goes by the literal meaning of the words, but which are expressed in this manner to accommodate the incapacity of common people; likewise, for the few who deserve to be separated from the masses, it is necessary that wise interpreters produce their true meaning and indicate the particular reasons why they have been expressed by means of such words.

Thus, given that in many places the Scripture is not only capable but necessarily in need of interpretations different from the apparent meaning of the words, it seems to me that in disputes about natural phenomena it should be reserved to the last place. For the Holy Scripture and nature both equally derive from the divine Word, the former as the dictation of the Holy Spirit, the latter as the most obedient executrix of God’s commands; moreover, in order to adapt itself to the understanding of all people, it was appropriate for the Scripture to say many things which are different from absolute truth, in appearance and in regard to the meaning of the words; on the other hand, nature is inexorable and immutable, and she does not care at all whether or not her recondite reasons and modes of operations are revealed to human understanding, and so she never transgresses the terms of the laws imposed on her; therefore, whatever sensory experience places before our eyes or necessary demonstrations prove to us concerning natural effects should not in any way be called into question on account of scriptural passages whose words appear to have a different meaning, since not every statement of the Scripture is bound to obligations as severely as each effect of nature. Indeed, because of the aim of adapting itself to the capacity of unrefined
and undisciplined peoples, the Scripture has not abstained from somewhat concealing its most basic dogmas, thus attributing to God himself properties contrary to and very far from his essence; so who will categorically maintain that, in speaking even incidentally of the earth of the sun or other creatures, it abandoned this aim and chose to restrict itself rigorously within the limited and narrow meanings of the words: This would have been especially problematic when saying about these creatures things which are very far from the primary function of the Holy Writ, indeed things which, if said and put forth in their naked and unadorned truth, would more likely harm its primary intention and make people more resistant to persuasion about the articles pertaining to salvation.

Given this, and moreover it being obvious that two truths can never contradict each other, the task of wise interpreters is to strive to find the true meanings of scriptural passages agreeing with those physical conclusions of which we are already certain and sure from clear sensory experience or from necessary demonstrations. Furthermore, as I already said, though the Scripture was inspired by the Holy Spirit, because of the mentioned reasons many passages admit of interpretations far removed from the literal meaning, and also we cannot assert with certainty that all interpreters speak by divine inspiration; hence I should think it would be prudent not to allow anyone to oblige scriptural passages to have to maintain the truth of any physical conclusions whose contrary could ever be proved to us by the senses and demonstrative and necessary reasons. Who wants to fix a limit for the human mind? Who wants to assert that everything which is knowable in the world is already known? Because of this, it would be most advisable not to add anything beyond necessity to the articles concerning salvation and the definition of the Faith, which are firm enough that there is no danger of any valid and effective doctrine ever rising against them. If this is so, what greater disorder would result from adding them upon request by persons of whom we do not know whether they speak with celestial inspiration, and of whom also we see clearly that they are completely lacking in the intelligence needed to understand, let alone to criticize, the demonstrations by means of which the most exact sciences proceed in the confirmation of some of their conclusions?
I should believe that the authority of the Holy Write has merely
the aim of persuading men of those article and propositions which
are necessary for their salvation and surpass all human reason, and so
could not become credible through some other science or any other
means except the mouth of the Holy Spirit itself. However, I do not
think it necessary to believe that the same God who has furnished us
with senses, language, and intellect would want to bypass their use
and give us by other means the information we can obtain with them.
This applies especially to those sciences about which one can read
only very small phrases and scattered conclusions in the Scripture,
as is particularly the case for astronomy, of which it contains such a
small portion that one does not even find in it the names of all the
planets; but if the first sacred writers had been thinking of persuading
the people about the arrangement and the movements of the heav-
enly bodies, they would not have treated of them so sparsely, which is
to say almost nothing in comparison to the infinity of very lofty and
admirable conclusions contained in such a science.

So you see, if I am not mistaken, how disorderly is the procedure of
those who in disputes about natural phenomena that do not directly
involve the Faith give first place to scriptural passages, which they quite
often misunderstand anyway. However, if these people really believe
they have grasped the true meaning of a particular scriptural passage,
and if they consequently feel sure of possessing the absolute truth on
the question they intend to dispute about, then let them sincerely tell
me whether they think that someone in a scientific dispute who hap-
pens to be right has a great advantage over another who happens to
be wrong. I know they will answer Yes, and that the one who supports
the true side will be able to provide a thousand experiments and a
thousand necessary demonstrations for his side, whereas the other
person can have nothing but sophisms, paralogisms, and fallacies. But
is they know they have such an advantage over their opponents as long
as the discussion is limited to physical questions and only philosophical
weapons are used, why is it that when they come to the meeting they
immediately introduce an irresistible and terrible weapon, the mere
sight of which terrifies even the most skillful and expert champion? If
I must tell the truth, I believe it is they who are the most terrified, and
that they are trying to find a way of not letting the opponent approach because they feel unable to resist his assaults. However, consider that, as I just said, whoever has truth on his side has a great, indeed the greatest, advantage over the opponent, and that it is impossible for two truths to contradict each other; it follows therefore that we must not fear any assaults launched against us by anyone, as long as we are allowed to speak and to be heard by competent persons who are not excessively upset by their own emotions and interests.

To confirm this, I now come to examining the specific passage of Joshua, concerning which you put forth three theses for their Most Serene Highness. I take the third one, which you advanced as mine (as indeed it is), but I add some other consideration that I do not believe I have ever told you.

Let us then assume and concede to the opponent that the words of the sacred text should be taken precisely in their literal meaning, namely that in answer to Joshua’s prayers God made the sun stop and lengthened the day, so that as a result he achieved victory; but I request that the same rule should apply to both, so that the opponent should not pretend to tie me and to leave himself free to change or modify the meanings of the words. Given this, I say that this passage shows clearly the falsity and impossibility of the Aristotelian and Ptolemaic world system, and on the other hand agrees very well with the Copernican one.

I first ask the opponent whether he knows with how many motions the sun moves. If he knows, he must answer that it moves with two motions, namely with the annual motion from west to east and with the diurnal motion in the opposite direction from east to west.

Then, secondly, I ask him whether these two motions, so different and almost contrary to each other, belong to the sun and are its own to an equal extent. The answer must be No, but that only one is specifically its own, namely the annual motion, whereas the other is not but belongs to the highest heaven, I mean the Prime Mobile; the latter carries along with it the sun as well as the other planets and the stellar sphere, forcing them to make a revolution around the earth in twenty-four hours, with a motion, as I said, almost contrary to their own natural motion.
Coming to the third question, I ask him with which of these two motions the sun produces night and day, that is, whether with its own motion or else with that of the Prime Mobile. The answer must be that night and day are effects of the motion of the Prime Mobile and that what depends on the sun’s own motion is not night or day but the various seasons and the year itself.

Now, if the day derives not from the sun’s motion but from that of the Prime Mobile, who does not see that to lengthen the day one must stop the Prime Mobile and not the sun? Indeed, is there anyone who understands these first elements of astronomy and does not know that, if God had stopped the sun’s motion, He would have cut and shortened the day instead of lengthening it? For, the sun’s motion being contrary to the diurnal turning, the more the sun moves toward the east the more its progression toward the west is slowed down, whereas by its motion being diminished or annihilated the sun would set that much sooner; this phenomenon is observed in the moon, whose diurnal revolutions are slower than those of the sun inasmuch as is own motion is faster than that of the sun. It follows that it is absolutely impossible to stop the sun and lengthen the day in the system of Ptolemy and Aristotle, and therefore either the motions must not be arranged as Ptolemy says or we must modify the meaning of the words of the Scripture; we would have to claim that, when it says that God stopped the sun, it meant to say that He stopped the Prime Mobile, and that is said the contrary of what it would have said if speaking to educated men in order to adapt itself to the capacity of those who are barely able to understand the rising and setting of the sun.

Add to this that it is not believable that God would stop only the sun, letting the other spheres proceed; for He would have unnecessarily altered and upset all the order, appearances, and arrangements of the other stars in relation to the sun, and would have greatly disturbed the whole system of nature. On the other hand, it is believable that He would stop the whole system of celestial spheres, which could then together return to their operations without any confusion or change after the period of intervening rest.

However, we have already agreed not to change the meaning of the words in the text; therefore it is necessary to resort to another
arrangement of the parts of the world, and to see whether the literal meaning of the words flows directly and without obstacle from its point of view. This is in fact what we see happening.

For I have discovered and conclusively demonstrated that the solar globe turns on itself, completing an entire rotation in about one lunar month, in exactly the same direction as all the other heavenly revolutions; moreover, it is very probable and reasonable that, as the chief instrument and minister of nature and almost the heart of the world, the sun gives not only light (as it obviously does) but also motion to all the planets that revolve around it; hence, if in conformity with Copernicus’s position the diurnal motion is attributed to the earth, anyone can see that is sufficed stopping the sun to stop the whole system, and thus to lengthen the period of the diurnal illumination without altering in any way the rest of the mutual relationships of the planets; and that is exactly how the words of the sacred text sound. Here then is the manner in which by stopping the sun one can lengthen the day on the earth, without introducing any confusion among the parts of the world and without altering the words of the Scripture.

I have written much more than is appropriate in the view of my slight illness. So I end by reminding you that I am at your service, and I kiss your hands and pray the Lord to give you happy holidays and all you desire.

Florence, December, 21, 1613
To Your Very Reverend Paternity.
Your Most Affectionate Servant, Galileo Galilei
To the Most Serene Grand Duchess Mother:

Some years ago, as Your Serene Highness well knows, I discovered in the heavens many things that had not been seen before our own age. The novelty of these things, as well as some consequences which followed from them in contradiction to the physical notions commonly held among academic philosophers, stirred up against me no small number of professors— as if I had placed these things in the sky with my own hands in order to upset nature and overturn the sciences. They seemed to forget that the increase of known truths stimulates the investigation, establishment, and growth of the arts; not their diminution or destruction.

Showing a greater fondness for their own opinions than for truth they sought to deny and disprove the new things which, if they had cared to look for themselves, their own senses would have demonstrated to them. To this end they hurled various charges and published numerous writings filled with vain arguments, and they made the grave mistake of sprinkling these with passages taken from places in the Bible which they had failed to understand properly, and which were ill-suited to their purposes.

These men would perhaps not have fallen into such error had they but paid attention to a most useful doctrine of St. Augustine’s, relative to our making positive statements about things which are obscure and hard to understand by means of reason alone. Speaking of a certain
physical conclusion about the heavenly bodies, he wrote: “Now keeping always our respect for moderation in grave piety, we ought not to believe anything inadvisedly on a dubious point, lest in favor to our error we conceive a prejudice against something that truth hereafter may reveal to be not contrary in any way to the sacred books of either the Old or the New Testament.”

Well, the passage of time has revealed to everyone the truths that I previously set forth; and, together with the truth of the facts, there has come to light the great difference in attitude between those who simply and dispassionately refused to admit the discoveries to be true, and those who combined with their incredulity some reckless passion of their own. Men who were well grounded in astronomical and physical science were persuaded as soon as they received my first message. There were others who denied them or remained in doubt only because of their novel and unexpected character, and because they had not yet had the opportunity to see for themselves. These men have by degrees come to be satisfied. But some, besides allegiance to their original error, possess I know not what fanciful interest in remaining hostile not so much toward the things in question as toward their discoverer. No longer being able to deny them, these men now take refuge in obstinate silence, but being more than ever exasperated by that which has pacified and quieted other men, they divert their thoughts to other fancies and seek new ways to damage me.

I should pay no more attention to them than to those who previously contradicted me—at whom I always laugh, being assured of the eventual outcome—were it not that in their new calumnies and persecutions I perceive that they do not stop at proving themselves more learned than I am (a claim which I scarcely contest), but go so far as to cast against me the imputations of crimes which must be, and are, more abhorrent to me than death itself. I cannot remain satisfied merely to know that the injustice of this is recognized by those who are acquainted with these men and with me, as perhaps it is not known to others.

Persisting in their original resolve to destroy me and everything mine by any means they can think of, these men are aware of my views
in astronomy and philosophy. They know that as to the arrangement of the parts of the universe, I hold the sun to be situated motionless in the center of the revolution of the celestial orbs while the earth revolves about the sun. They know also that I support this position not only by refuting the arguments of Ptolemy and Aristotle, but by producing many counter-arguments; in particular, some which relate to physical effects whose causes can perhaps be assigned in no other way. In addition there are astronomical arguments derived from many things in my new celestial discoveries that plainly confute the Ptolemaic system while admirably agreeing with and confirming the contrary hypothesis. Possibly because they are disturbed by the known truth of other propositions of mine which differ from those commonly held, and therefore mistrusting their defense so long as they confine themselves to the field of philosophy, these men have resolved to fabricate a shield for their fallacies out of the mantle of pretended religion and the authority of the Bible. These they apply with little judgement to the refutation of arguments that they do not understand and have not even listened to.

First they have endeavored to spread the opinion that such propositions in general are contrary to the Bible and are consequently damnable and heretical. They know that it is human nature to take up causes whereby a man may oppress his neighbor, no matter how unjustly, rather than those from which a man may receive some just encouragement. Hence they have had no trouble in finding men who would preach the damnable and heresy of the new doctrine from their very pulpits with unwonted confidence, thus doing impious and inconsiderate injury not only to that doctrine and its followers but to all mathematics and mathematicians in general. Next, becoming bolder, and hoping (though vainly) that this seed which first took root in their hypocritical minds would send out branches and ascend to heaven, they began scattering rumors among the people that before long this doctrine would be condemned by the supreme authority. They know, too, that official condemnation would not only suppress the two propositions which I have mentioned, but would render damnable all other astronomical and physical statements and observations that have any necessary relation or connection with these.
In order to facilitate their designs, they seek so far as possible (at least among the common people) to make this opinion seem new and to belong to me alone. They pretend not to know that its author, or rather its restorer and confirmer, was Nicholas Copernicus; and that he was not only a Catholic, but a priest and a canon. He was in fact so esteemed by the church that when the Lateran Council under Leo X took up the correction of the church calendar, Copernicus was called to Rome from the most remote parts of Germany to undertake its reform. At that time the calendar was defective because the true measures of the year and the lunar month were not exactly known. The Bishop of Culm, then superintendent of this matter, assigned Copernicus to seek more light and greater certainty concerning the celestial motions by means of constant study and labor. With Herculean toil he set his admirable mind to this task, and he made such great progress in this science and brought our knowledge of the heavenly motions to such precision that he became celebrated as an astronomer. Since that time not only has the calendar been regulated by his teachings, but tables of all the motions of the planets have been calculated as well.

Having reduced his system into six books, he published these at the instance of the Cardinal of Capua and the Bishop of Culm. And since he had assumed his laborious enterprise by order of the supreme pontiff, he dedicated this book *On the celestial revolutions* to Pope Paul III. When printed, the book was accepted by the holy Church, and it has been read and studied by everyone without the faintest hint of any objection ever being conceived against its doctrines. Yet now that manifest experiences and necessary proofs have shown them to be well grounded, persons exist who would strip the author of his reward without so much as looking at his book, and add the shame of having him pronounced a heretic. All this they would do merely to satisfy their personal displeasure conceived without any cause against another man, who has no interest in Copernicus beyond approving his teachings.

Now as to the false aspersions which they so unjustly seek to cast upon me, I have thought it necessary to justify myself in the eyes of all men, whose judgment in matters of religion and of reputation I must hold in great esteem. I shall therefore discourse of the particulars which these men produce to make this opinion detested and to have
it condemned not merely as false but as heretical. To this end they make a shield of their hypocritical zeal for religion. They go about invoking the Bible, which they would have minister to their deceitful purposes. Contrary to the sense of the Bible and the intention of the holy Fathers, if I am not mistaken, they would extend such authorities until even in purely physical matters - where faith is not involved - they would have us altogether abandon reason and the evidence of our senses in favor of some biblical passage, though under the surface meaning of its words this passage may contain a different sense.

I hope to show that I proceed with much greater piety than they do, when I argue not against condemning this book, but against condemning it in the way they suggest - that is, without understanding it, weighing it, or so much as reading it. For Copernicus never discusses matters of religion or faith, nor does he use argument that depend in any way upon the authority of sacred writings which he might have interpreted erroneously. He stands always upon physical conclusions pertaining to the celestial motions, and deals with them by astronomical and geometrical demonstrations, founded primarily upon sense experiences and very exact observations. He did not ignore the Bible, but he knew very well that if his doctrine were proved, then it could not contradict the Scriptures when they were rightly understood and thus at the end of his letter of dedication, addressing the pope, he said:

“If there should chance to be any exegetes ignorant of mathematics who pretend to skill in that discipline, and dare to condemn and censure this hypothesis of mine upon the authority of some scriptural passage twisted to their purpose, I value them not, but disdain their unconsidered judgment. For it is known that Lactantius - a poor mathematician though in other respects a worthy author - writes very childishly about the shape of the earth when he scoffs at those who affirm it to be a globe. Hence it should not seem strange to the ingenious if people of that sort should in turn deride me. But mathematics is written for mathematicians, by whom, if I am not deceived, these labors of mine will be recognized as contributing something to their domain, as also to that of the Church over which Your Holiness now reigns.”
Such are the people who labor to persuade us that an author like Copernicus may be condemned without being read, and who produce various authorities from the Bible, from theologians, and from Church Councils to make us believe that this is not only lawful but commendable. Since I hold these to be of supreme authority I consider it rank temerity for anyone to contradict them—when employed according to the usage of the holy Church. Yet I do not believe it is wrong to speak out when there is reason to suspect that other men wish, for some personal motive, to produce and employ such authorities for purposes quite different from the sacred intention of the holy Church.

Therefore I declare (and my sincerity will make itself manifest) not only that I mean to submit myself freely and renounce any errors into which I may fall in this discourse through ignorance of matters pertaining to religion, but that I do not desire in these matters to engage in disputes with anyone, even on points that are disputable. My goal is this alone; that if, among errors that may abound in these considerations of a subject remote from my profession, there is anything that may be serviceable to the holy Church in making a decision concerning the Copernican system, it may be taken and utilized as seems best to the superiors. And if not, let my book be torn and burnt, as I neither intend nor pretend to gain from it any fruit that is not pious and Catholic. And though many of the things I shall reprove have been heard by my own ears, I shall freely grant to those who have spoken them that they never said them, if that is what they wish, and I shall confess myself to have been mistaken. Hence let whatever I reply be addressed not to them, but to whoever may have held such opinions.

The reason produced for condemning the opinion that the earth moves and the sun stands still in many places in the Bible one may read that the sun moves and the earth stands still. Since the Bible cannot err; it follows as a necessary consequence that anyone takes an erroneous and heretical position who maintains that the sun is inherently motionless and the earth movable.

With regard to this argument, I think in the first place that it is very pious to say and prudent to affirm that the holy Bible can never speak untruth—whenever its true meaning is understood. But I believe nobody
will deny that it is often very abstruse, and may say things which are quite different from what its bare words signify. Hence in expounding the Bible if one were always to confine oneself to the unadorned grammatical meaning, one might fall into error. Not only contradictions and propositions far from true might thus be made to appear in the Bible, but even grave heresies and follies. Thus it would be necessary to assign to God feet, hands and eyes, as well as corporeal and human affections, such as anger, repentance, hatred, and sometimes even the forgetting of things past and ignorance of those to come. These propositions uttered by the Holy Ghost were set down in that manner by the sacred scribes in order to accommodate them to the capacities of the common people, who are rude and unlearned. For the sake of those who deserve to be separated from the herd, it is necessary that wise expositors should produce the true senses of such passages, together with the special reasons for which they were set down in these words. This doctrine is so widespread and so definite with all theologians that it would be superfluous to adduce evidence for it.

Hence I think that I may reasonably conclude that whenever the Bible has occasion to speak of any physical conclusion (especially those which are very abstruse and hard to understand), the rule has been observed of avoiding confusion in the minds of the common people which would render them contumacious toward the higher mysteries. Now the Bible, merely to condescend to popular capacity, has not hesitated to obscure some very important pronouncements, attributing to God himself some qualities extremely remote from (and even contrary to) His essence. Who, then, would positively declare that this principle has been set aside, and the Bible has confined itself rigorously to the bare and restricted sense of its words, when speaking but casually of the earth, of water, of the sun, or of any other created thing? Especially in view of the fact that these things in no way concern the primary purpose of the sacred writings, which is the service of God and the salvation of souls - matters infinitely beyond the comprehension of the common people.

This being granted, I think that in discussions of physical problems we ought to begin not from the authority of scriptural passages but from sense-experiences and necessary demonstrations; for the
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holy Bible and the phenomena of nature proceed alike from the
divine Word the former as the dictate of the Holy Ghost and the latter
as the observant executrix of God’s commands. It is necessary for the
Bible, in order to be accommodated to the understanding of every
man, to speak many things which appear to differ from the absolute
truth so far as the bare meaning of the words is concerned. But
Nature, on the other hand, is inexorable and immutable; she never
transgresses the laws imposed upon her, or cares a whit whether her
abstruse reasons and methods of operation are understandable to
men. For that reason it appears that nothing physical which sense-
experience sets before our eyes, or which necessary demonstrations
prove to us, ought to be called in question (much less condemned)
upon the testimony of biblical passages which may have some dif-
f erent meaning beneath their words. For the Bible is not chained
in every expression to conditions as strict as those which govern all
physical effects; nor is God any less excellently revealed in Nature’s
actions than in the sacred statements of the Bible. Perhaps this is
what Tertullian meant by these words:

“We conclude that God is known first through Nature, and then
again, more particularly, by doctrine, by Nature in His works,
and by doctrine in His revealed word.”

From this I do not mean to infer that we need not have an extraor-
dinary esteem for the passages of holy Scripture. On the contrary,
having arrived at any certainties in physics, we ought to utilize these
as the most appropriate aids in the true exposition of the Bible and in
the investigation of those meanings which are necessarily contained
therein, for these must be concordant with demonstrated truths. I
should judge that the authority of the Bible was designed to persuade
men of those articles and propositions which, surpassing all human
reasoning could not be made credible by science, or by any other
means than through the very mouth of the Holy Spirit.

Yet even in those propositions which are not matters of faith, this
authority ought to be preferred over that of all human writings which
are supported only by bare assertions or probable arguments, and
not set forth in a demonstrative way. This I hold to be necessary and proper to the same extent that divine wisdom surpasses all human judgment and conjecture.

But I do not feel obliged to believe that the same God who has endowed us with senses, reason and intellect has intended us to forego their use and by some other means to give us knowledge which we can attain by them. He would not require us to deny sense and reason in physical matters which are set before our eyes and minds by direct experience or necessary demonstrations. This must be especially true in those sciences of which but the faintest trace (and that consisting of conclusions) is to be found in the Bible. Of astronomy; for instance, so little is found that none of the planets except Venus are so much as mentioned, and this only once or twice under the name of “Lucifer.” If the sacred scribes had had any intention of teaching people certain arrangements and motions of the heavenly bodies, or had they wished us to derive such knowledge from the Bible, then in my opinion they would not have spoken of these matters so sparingly in comparison with the infinite number of admirable conclusions which are demonstrated in that science. Far from pretending to teach us the constitution and motions of the heavens and other stars, with their shapes, magnitudes, and distances, the authors of the Bible intentionally forbore to speak of these things, though all were quite well known to them. Such is the opinion of the holiest and most learned Fathers, and in St. Augustine we find the following words:

“It is likewise commonly asked what we may believe about the form and shape of the heavens according to the Scriptures, for many contend much about these matters. But with superior prudence our authors have forbore to speak of this, as in no way furthering the student with respect to a blessed life-and, more important still, as taking up much of that time which should be spent in holy exercises. What is it to me whether heaven, like a sphere surrounds the earth on all sides as a mass balanced in the center of the universe, or whether like a dish it merely covers and overcasts the earth? Belief in Scripture is urged rather for the reason we have often mentioned; that is, in order that no one, through
ignorance of divine passages, finding anything in our Bibles or hearing anything cited from them of such a nature as may seem to oppose manifest conclusions, should be induced to suspect their truth when they teach, relate, and deliver more profitable matters. Hence let it be said briefly, touching the form of heaven, that our authors knew the truth but the Holy Spirit did not desire that men should learn things that are useful to no one for salvation.”

The same disregard of these sacred authors toward beliefs about the phenomena of the celestial bodies is repeated to us by St. Augustine in his next chapter. On the question whether we are to believe that the heaven moves or stands still, he writes thus:

“She of the brethren raise a question concerning the motion of heaven, whether it is fixed or moved. If it is moved, they say, how is it a firmament? If it stands still, how do these stars which are held fixed in it go round from east to west, the more northerly performing shorter circuits near the pole, so that the heaven (if there is another pole unknown to us) may seem to revolve upon some axis, or (if there is no other pole) may be thought to move as a discus? To these men I reply that it would require many subtle and profound reasonings to find out which of these things is actually so; but to undertake this and discuss it is consistent neither with my leisure nor with the duty of those whom I desire to instruct in essential matters more directly conducing to their salvation and to the benefit of the holy Church.”

From these things it follows as a necessary consequence that, since the Holy Ghost did not intend to teach us whether heaven moves or stands still, whether its shape is spherical or like a discus or extended in a plane, nor whether the earth is located at its center or off to one side, then so much the less was it intended to settle for us any other conclusion of the same kind. And the motion or rest of the earth and the sun is so closely linked with the things just named, that without a determination of the one, neither side can be taken in the other matters. Now if the Holy Spirit has purposely neglected to teach us
propositions of this sort as irrelevant to the highest goal (that is, to our salvation), how can anyone affirm that it is obligatory to take sides on them, that one belief is required by faith, while the other side is erroneous? Can an opinion be heretical and yet have no concern with the salvation of souls? Can the Holy Ghost be asserted not to have intended teaching us something that does concern our salvation? I would say here something that was heard from an ecclesiastic of the most eminent degree: “That the intention of the Holy Ghost is to teach us how one goes to heaven, not how heaven goes.”

But let us again consider the degree to which necessary demonstrations and sense experiences ought to be respected in physical conclusions, and the authority they have enjoyed at the hands of holy and learned theologians. From among a hundred attestations I have selected the following:

“We must also take heed, in handling the doctrine of Moses, that we altogether avoid saying positively and confidently anything which contradicts manifest experiences and the reasoning of philosophy or the other sciences. For since every truth is in agreement with all other truth, the truth of Holy Writ cannot be contrary to the solid reasons and experiences of human knowledge.”

And in St. Augustine we read:

“If anyone shall set the authority of Holy Writ against clear and manifest reason, he who does this knows not what he has undertaken; for he opposes to the truth not the meaning of the Bible, which is beyond his comprehension, but rather his own interpretation, not what is in the Bible, but what he has found in himself and imagines to be there.”

This granted, and it being true that two truths cannot contradict one another, it is the function of expositors to seek out the true senses of scriptural texts. These will unquestionably accord with the physical conclusions which manifest sense and necessary demonstrations have previously made certain to us. Now the Bible, as has been remarked,
admits in many places expositions that are remote from the significations of the words for reasons we have already given. Moreover, we are unable to affirm that all interpreters of the Bible speak by Divine inspiration for if that were so there would exist no differences among them about the sense of a given passage. Hence I should think it would be the part of prudence not to permit anyone to usurp scriptural texts and force them in some way to maintain any physical conclusion to be true, when at some future time the senses and demonstrative or necessary reasons may show the contrary. Who indeed will set bounds to human ingenuity? Who will assert that everything in the universe capable of being perceived is already discovered and known? Let us rather confess quite truly that “Those truths which we know are very few in comparison with those which we do not know.”

We have it from the very mouth of the Holy Ghost that God delivered up the world to disputations, so that man cannot find out the work that God hath done from the beginning even to the end. In my opinion no one, in contradiction to that dictum, should close the road to free philosophizing about mundane and physical things, as if everything had already been discovered and revealed with certainty. Nor should it be considered rash not to be satisfied with those opinions which have become common. No one should be scorned in physical disputes for not holding to the opinions which happen to please other people best, especially concerning problems which have been debated among the greatest philosophers for thousands of years. One of these is the stability of the sun mobility of the earth, a doctrine believed by Pythagoras and all his followers, by Heracleides of Pontus (who was one of them), by Philolaus, the teacher of Plato, and by Plato himself according to Aristotle. Plutarch writes in his Life of Numa that Plato, when he had grown old, said it was absurd to believe otherwise. The same doctrine was held by Aristarchus of Samos, as Archimedes tells us; by Seleucus the mathematician, by Nicetas the philosopher (on the testimony of Cicero), and by many others. Finally this opinion has been amplified and confirmed with many observations and demonstrations by Nicholas Copernicus. And Seneca, a most eminent philosopher, advises us in his book on comets that we should more diligently seek
to ascertain whether it is in the sky or in the earth that the diurnal rotation resides.

Hence it would probably be wise and useful counsel if, beyond articles which concern salvation and the establishment of our Faith, against the stability of which there is no danger whatever that any valid and effective doctrine can ever arise, men would not aggregate further articles unnecessarily. And it would certainly be preposterous to introduce them at the request of persons, who, besides not being known to speak by inspiration of divine grace, are clearly seen to lack that understanding which is necessary in order to comprehend, let alone discuss, the demonstrations by which such conclusions are supported in the subtler sciences. If I may speak my opinion freely, I should say further that it would perhaps fit in better with the decorum and majesty of the sacred writings to take measures for preventing every shallow and vulgar writer from giving to his compositions (often grounded upon foolish fancies) an air of authority by inserting in them passages from the Bible, interpreted (or rather distorted) into senses as far from the right meaning of Scripture as those authors are near to absurdity who thus ostentatiously adorn their writings. Of such abuses many examples might be produced, but for the present I shall confine myself to two which are germane to these astronomical matters. The first concerns those writings which were published against the existence of the Medicean planets recently discovered by me, in which many passages of holy Scripture were cited. Now that everyone has seen these planets, I should like to know what new interpretations those same antagonists employ in expounding the Scripture and excusing their own simplicity. My other example is that of a man who has lately published, in defiance of astronomers and philosophers, the opinion that the moon does not receive its light from the sun but is brilliant by its own nature. He supports this fancy (or rather thinks he does) by sundry texts of Scripture which he believes cannot be explained unless his theory is true; yet that the moon is inherently dark is surely as plain as daylight.

It is obvious that such authors, not having penetrated the true senses of Scripture, would impose upon others an obligation to subscribe to conclusions that are repugnant to manifest reason and sense, if they had any authority to do so. God forbid that this sort of abuse
should gain countenance and authority, for then in a short time it
would be necessary to proscribe all the contemplative sciences. People
who are unable to understand perfectly both the Bible and the science
far outnumber those who do understand them. The former, glanc-
ing superficially through the Bible, would arrogate to themselves the
authority to decree upon every question of physics on the strength of
some word which they have misunderstood, and which was employed
by the sacred authors for some different purpose. And the smaller
number of understanding men could not dam up the furious tor-
rent of such people, who would gain the majority of followers simply
because it is much more pleasant to gain a reputation for wisdom
without effort or study than to consume oneself tirelessly in the most
laborious disciplines. Let us therefore render thanks to Almighty God,
who in His beneficence protects us from this danger by depriving such
persons of all authority, reposing the power of consultation, decision,
and decree on such important matters in the high wisdom and benev-
olence of most prudent Fathers, and in the supreme authority of those
who cannot fail to order matters properly under the guidance of the
Holy Ghost. Hence we need not concern ourselves with the shallow-
ness of those men whom grave and holy authors rightly reproach,
and of whom in particular St. Jerome said, in reference to the Bible:

“This is ventured upon, lacerated, and taught by the garrulous old
woman, the doting old man, and the prattling sophist before they
have learned it. Others, led on by pride, weigh heavy words and
philosophize amongst women concerning holy Scripture. Others-
oh shame!-learn from women what they teach to men, and (as if
that were not enough) glibly expound to others that which they
themselves do not understand. I forebear to speak of those of my
own profession who, attaining a knowledge of the holy Scriptures
after mundane learning, tickle the ears of the people with affect-
ed and studied expressions, and declare that everything they say
is to be taken as the law of God. Not bothering to learn what the
prophets and the apostles have maintained, they wrest incongru-
ous testimonies into their own senses-as if distorting passages and
twisting the Bible to their individual and contradictory whims were the genuine way of teaching, and not a corrupt one.”

I do not wish to place in the number of such lay writers some theologians whom I consider men of profound learning and devout behavior, and who are therefore held by me in great esteem and veneration. Yet I cannot deny that I feel some discomfort which I should like to have removed, when I hear them pretend to the power of constraining others by scriptural authority to follow in a physical dispute that opinion which they think best agrees with the Bible, and then believe themselves not bound to answer the opposing reasons and experiences. In explanation and support of this opinion they say that since theology is queen of all the sciences, she need not bend in any way to accommodate herself to the teachings of less worthy sciences which are subordinate to her; these others must rather be referred to her as their supreme empress, changing and altering their conclusions according to her statutes and decrees. They add further that if in the inferior sciences any conclusion should be taken as certain in virtue of demonstrations or experiences, while in the Bible another conclusion is found repugnant to this, then the professors of that science should themselves undertake to undo their proofs and discover the fallacies in their own experiences, without bothering the theologians and exegetes. For, they say, it does not become the dignity of theology to stoop to the investigation of fallacies in the subordinate sciences; it is sufficient for her merely to determine the truth of a given conclusion with absolute authority, secure in her inability to err.

Now the physical conclusions in which they say we ought to be satisfied by Scripture, without glossing or expounding it in senses different from the literal, are those concerning which the Bible always speaks in the same manner and which the holy Fathers all receive and expound in the same way. But with regard to these judgments I have had occasion to consider several things, and I shall set them forth in order that I may be corrected by those who understand more than I do in these matters—by their decisions I submit at all times.
First I question whether there is not some equivocation in failing to specify the virtues which entitle sacred theology to the title of “queen.” It might deserve that name by reason of including everything that is included from all the other sciences and establishing everything by better methods and with profounder learning. It is thus, for example, that the rules for measuring fields and keeping accounts are much more excellently contained in arithmetic and in the geometry of Euclid than in the practices of surveyors and accountants. Or theology might be queen because of being occupied with a subject which excels in dignity all the subjects which compose the other sciences, and because her teachings are divulged in more sublime ways.

That the title and authority of queen belongs to theology in the first sense, I think, will not be affirmed by theologians who have any skill in the other sciences. None of these, I think, will say that geometry, astronomy, music, and medicine are much more excellently contained in the Bible than they are in the books of Archimedes, Ptolemy, Boethius, and Galen. Hence it seems likely that regal preeminence is given to theology in the second sense; that is, by reason of its subject and the miraculous communication of divine revelation of conclusions which could not be conceived by men in any other way, concerning chiefly the attainment of eternal blessedness.

Let us grant then that theology is conversant with the loftiest divine contemplation, and occupies the regal throne among sciences by dignity. But acquiring the highest authority in this way, if she does not descend to the lower and humbler speculations of the subordinate sciences and has no regard for them because they are not concerned with blessedness, then her professors should not arrogate to themselves the authority to decide on controversies in professions which they have neither studied nor practiced. Why, this would be as if an absolute despot, being neither a physician nor an architect but knowing himself free to command, should undertake to administer medicines and erect buildings according to his whim—at grave peril of his poor patients’ lives, and the speedy collapse of his edifices.

Again, to command that the very professors of astronomy themselves see to the refutation of their own observations and proofs as mere fallacies and sophisms is to enjoin something that lies beyond any
possibility of accomplishment. For this would amount to commandeering that they must not see what they see and must not understand what they know, and that in searching they must find the opposite of what they actually encounter. Before this could be done they would have to be taught how to make one mental faculty command another, and the inferior powers the superior, so that the imagination and the will might be forced to believe the opposite of what the intellect understands. I am referring at all times to merely physical propositions, and not to supernatural things which are matters of faith.

I entreat those wise and prudent Fathers to consider with great care the difference that exists between doctrines subject to proof and those subject to opinion. Considering the force exerted by logical deductions, they may ascertain that it is not in the power of the professors of demonstrative sciences to change their opinions at will and apply themselves first to one side and then to the other. There is a great difference between commanding a mathematician or a philosopher and influencing a lawyer or a merchant, for demonstrated conclusions about things in nature or in the heavens cannot be changed with the same facility as opinions about what is or is not lawful in a contract, bargain, or bill of exchange. This difference was well understood by the learned and holy Fathers, as proven by their having taken great pains in refuting philosophical fallacies. This may be found expressly in some of them; in particular, we find the following words of St. Augustine:

“It is to be held as an unquestionable truth that whatever the sages of this world have demonstrated concerning physical matters is in no way contrary to our Bibles, hence whatever the sages teach in their books that is contrary to the holy Scriptures may be concluded without any hesitation to be quite false. And according to our ability let us make this evident, and let us keep the faith of our Lord, in whom are hidden all the treasures of wisdom so that we neither become seduced by the verbiage of false philosophy nor frightened by the superstition of counterfeit religion.”

From the above words I conceive that I may deduce this doctrine
That in the books of the sages of this world there are contained some
physical truths which are soundly demonstrated, and others that are merely stated; as to the former, it is the office of wise divines to show that they do not contradict the holy Scriptures. And as to the propositions which are stated but not rigorously demonstrated, anything contrary to the Bible involved by them must be held undoubtedly false and should be proved so by every possible means.

Now if truly demonstrated physical conclusions need not be subordinated to biblical passages, but the latter must rather be shown not to interfere with the former, then before a physical proposition is condemned it must be shown to be not rigorously demonstrated—and this is to be done not by those who hold the proposition to be true, but by those who judge it to be false. This seems very reasonable and natural, for those who believe an argument to be false may much more easily find the fallacies in it than men who consider it to be true and conclusive. Indeed, in the latter case it will happen that the more the adherents of an opinion turn over their pages, examine the arguments, repeat the observations, and compare the experiences, the more they will be confirmed in that belief. And Your Highness knows what happened to the late mathematician of the University of Pisa who undertook in his old age to look into the Copernican doctrine in the hope of shaking its foundations and refuting it, since he considered it false only because he had never studied it. As it fell out, no sooner had he understood its grounds, procedures, and demonstrations than he found himself persuaded, and from an opponent he became a very staunch defender of it. I might also name other mathematicians who, moved by my latest discoveries, have confessed it necessary to alter the previously accepted system of the world, as this is simply unable to subsist any longer.

If in order to banish the opinion in question from the world it were sufficient to stop the mouth of a single man—as perhaps those men persuade themselves who, measuring the minds of others by their own, think it impossible that this doctrine should be able to continue to find adherents—then that would be very easily done. But things stand otherwise. To carry out such a decision it would be necessary not only to prohibit the book of Copernicus and the writings of other authors who follow the same opinion, but to ban the whole
science of astronomy. Furthermore, it would be necessary to forbid men to look at the heavens, in order that they might not see Mars and Venus sometimes quite near the earth and sometimes very distant, the variation being so great that Venus is forty times and Mars sixty times as large at one time as at another. And it would be necessary to prevent Venus being seen round at one time and forked at another, with very thin horns; as well as many other sensory observations which can never be reconciled with the Ptolemaic system in any way, but are very strong arguments for the Copernican. And to ban Copernicus now that his doctrine is daily reinforced by many new observations and by the learned applying themselves to the reading of his book, after this opinion has been allowed and tolerated for these many years during which it was less followed and less confirmed, would seem in my judgment to be a contravention of truth, and an attempt to hide and suppress her the more as she revealed herself the more clearly and plainly. Not to abolish and censure his whole book, but only to condemn as erroneous this particular proposition, would (if I am not mistaken) be a still greater detriment to the minds of men, since it would afford them occasion to see a proposition proved that it was heresy to believe. And to prohibit the whole science would be to censure a hundred passages of holy Scripture which teach us that the glory and greatness of Almighty God are marvelously discerned in all his works and divinely read in the open book of heaven. For let no one believe that reading the lofty concepts written in that book leads to nothing further than the mere seeing of the splendor of the sun and the stars and their rising and setting, which is as far as the eyes of brutes and of the vulgar can penetrate. Within its pages are couched mysteries so profound and concepts so sublime that the vigils, labors, and studies of hundreds upon hundreds of the most acute minds have still not pierced them, even after the continual investigations for thousands of years. The eyes of an idiot perceive little by beholding the external appearance of a human body, as compared with the wonderful contrivances which a careful and practiced anatomist or philosopher discovers in that same body when he seeks out the use of all those muscles, tendons, nerves, and bones; or when examining the functions of the heart and the other principal organs, he seeks
the seat of the vital faculties, notes and observes the admirable structure of the sense organs, and (without ever ceasing in his amazement and delight) contemplates the receptacles of the imagination, the memory, and the understanding. Likewise, that which presents itself to mere sight is as nothing in comparison with the high marvels that the ingenuity of learned men discovers in the heavens by long and accurate observation....

Your Highness may thus see how irregularly those persons proceed who in physical disputes arrange scriptural passages (and often those ill understood by them) in the front rank of their arguments. If these men really believe themselves to have the true sense of a given passage, it necessarily follows that they believe they have in hand the absolute truth of the conclusion they intend to debate. Hence they must know that they enjoy a great advantage over their opponents, whose lot it is to defend the false position; and he who maintains the truth will have many sense experiences and rigorous proofs on his side, whereas his antagonist cannot make use of anything but illusory appearances, quibbles, and fallacies. Now if these men know they have such advantages over the enemy even when they stay within proper bounds and produce no weapons other than those proper to philosophy, why do they, in the thick of the battle, betake themselves to a dreadful weapon which cannot be turned aside, and seek to vanquish the opponent by merely exhibiting it? If I may speak frankly, I believe they have themselves been vanquished, and, feeling unable to stand up against the assaults of the adversary, they seek ways of holding him off. To that end they would forbid him the use of reason, divine gift of Providence, and would abuse the just authority of holy Scripture- which, in the general opinion of theologians, can never oppose manifest experiences and necessary demonstrations when rightly understood and applied. If I am correct, it will stand them in no stead to go running to the Bible to cover up their inability to understand (let alone resolve) their opponents’ arguments, for the opinion which they fight has never been condemned by the holy Church. If they wish to proceed in sincerity, they should by silence confess themselves unable to deal with such matters. Let them freely admit that although they may argue that a position is false, it is not
in their power to censure a position as erroneous - or in the power of anyone except the Supreme Pontiff, or the Church Councils. Reflecting upon this, and knowing that a proposition cannot be both true and heretical, let them employ themselves in the business which is proper to them; namely, demonstrating its falsity. And when that is revealed, either there will no longer be any necessity to prohibit it (since it will have no followers), or else it may safely be prohibited without the risk of any scandal.

Therefore, let these men begin to apply themselves to an examination of the arguments of Copernicus and others, leaving condemnation of the doctrine as erroneous and heretical ‘ to the proper authorities. Among the circumspect and most wise Fathers, and in the absolute wisdom of one who cannot err, they may never hope to find the rash decisions into which they allow themselves to be hurried by some particular passion or personal interest. With regard to this opinion, and others which are not directly matters of faith, certainly no one doubts that the Supreme Pontiff has always an absolute power to approve or condemn; but it is not in the power of any created being to make things true or false, for this belongs to their own nature and to the fact. Therefore, in my judgment one should first be assured of the necessary and immutable truth of the fact, over which no man has power. This is wiser counsel than to condemn either side in the absence of such certainty, thus depriving oneself of continued authority and ability to choose by determining things which are now undetermined and open and still lodged in the will of supreme authority. And in brief, if it is impossible for a conclusion to be declared heretical while we remain in doubt as to its truth, then these men are wasting their time clamoring for condemnation of the motion of the earth and stability of the sun, which they have not yet demonstrated to be impossible or false.

Galileo, 1610.
If this Discourse appear too long to be read at once, it may be divided into six Parts: and, in the first, will be found various considerations touching the Sciences; in the second, the principal rules of the Method which the Author has discovered, in the third, certain of the rules of Morals which he has deduced from this Method; in the fourth, the reasonings by which he establishes the existence of God and of the Human Soul, which are the foundations of his Metaphysic; in the fifth, the order of the Physical questions which he has investigated, and, in particular, the explication of the motion of the heart and of some other difficulties pertaining to Medicine, as also the difference between the soul of man and that of the brutes; and, in the last, what the Author believes to be required in order to greater advancement in the investigation of Nature than has yet been made, with the reasons that have induced him to write.
PART I

Good sense is, of all things among men, the most equally distributed; for every one thinks himself so abundantly provided with it, that those even who are the most difficult to satisfy in everything else, do not usually desire a larger measure of this quality than they already possess. And in this it is not likely that all are mistaken the conviction is rather to be held as testifying that the power of judging aright and of distinguishing truth from error, which is properly what is called good sense or reason, is by nature equal in all men; and that the diversity of our opinions, consequently, does not arise from some being endowed with a larger share of reason than others, but solely from this, that we conduct our thoughts along different ways, and do not fix our attention on the same objects. For to be possessed of a vigorous mind is not enough; the prime requisite is rightly to apply it. The greatest minds, as they are capable of the highest excellences, are open likewise to the greatest aberrations; and those who travel very slowly may yet make far greater progress, provided they keep always to the straight road, than those who, while they run, forsake it.

For myself, I have never fancied my mind to be in any respect more perfect than those of the generality; on the contrary, I have often wished that I were equal to some others in promptitude of thought, or in clearness and distinctness of imagination, or in fullness and readiness of memory. And besides these, I know of no other qualities that contribute to the perfection of the mind; for as to the reason or sense, inasmuch as it is that alone which constitutes us men, and distinguishes us from the brutes, I am disposed to believe that it is to be found complete in each individual; and on this point to adopt
the common opinion of philosophers, who say that the difference of greater and less holds only among the accidents, and not among the forms or natures of individuals of the same species.

I will not hesitate, however, to avow my belief that it has been my singular good fortune to have very early in life fallen in with certain tracks which have conducted me to considerations and maxims, of which I have formed a method that gives me the means, as I think, of gradually augmenting my knowledge, and of raising it by little and little to the highest point which the mediocrity of my talents and the brief duration of my life will permit me to reach. For I have already reaped from it such fruits that, although I have been accustomed to think lowly enough of myself, and although when I look with the eye of a philosopher at the varied courses and pursuits of mankind at large, I find scarcely one which does not appear in vain and useless, I nevertheless derive the highest satisfaction from the progress I conceive myself to have already made in the search after truth, and cannot help entertaining such expectations of the future as to believe that if, among the occupations of men as men, there is any one really excellent and important, it is that which I have chosen.

After all, it is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgments of our friends are to be suspected when given in our favor. But I shall endeavor in this discourse to describe the paths I have followed, and to delineate my life as in a picture, in order that each one may also be able to judge of them for himself, and that in the general opinion entertained of them, as gathered from current report, I myself may have a new help towards instruction to be added to those I have been in the habit of employing.

My present design, then, is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavored to conduct my own. They who set themselves to give precepts must of course regard themselves as possessed of greater skill than those to whom they prescribe; and if they err in the slightest particular, they subject themselves to censure. But as this tract is put forth merely as a history, or, if you will, as a
tale, in which, amid some examples worthy of imitation, there will be
found, perhaps, as many more which it were advisable not to follow,
I hope it will prove useful to some without being hurtful to any, and
that my openness will find some favor with all.

From my childhood, I have been familiar with letters; and as I was
given to believe that by their help a clear and certain knowledge of
all that is useful in life might be acquired, I was ardently desirous of
instruction. But as soon as I had finished the entire course of study,
at the close of which it is customary to be admitted into the order of
the learned, I completely changed my opinion. For I found myself
involved in so many doubts and errors, that I was convinced I had
advanced no farther in all my attempts at learning, than the discovery
at every turn of my own ignorance. And yet I was studying in one of
the most celebrated schools in Europe, in which I thought there must
be learned men, if such were anywhere to be found. I had been taught
all that others learned there; and not contented with the sciences
actually taught us, I had, in addition, read all the books that had fallen
into my hands, treating of such branches as are esteemed the most
curious and rare. I knew the judgment which others had formed of
me; and I did not find that I was considered inferior to my fellows,
although there were among them some who were already marked out
to fill the places of our instructors. And, in fine, our age appeared to
me as flourishing, and as fertile in powerful minds as any preceding
one. I was thus led to take the liberty of judging of all other men by
myself, and of concluding that there was no science in existence that
was of such a nature as I had previously been given to believe.

I still continued, however, to hold in esteem the studies of the
schools. I was aware that the languages taught in them are necessary
to the understanding of the writings of the ancients; that the grace
of fable stirs the mind; that the memorable deeds of history elevate
it; and, if read with discretion, aid in forming the judgment; that
the perusal of all excellent books is, as it were, to interview with the
noblest men of past ages, who have written them, and even a studied
interview, in which are discovered to us only their choicest thoughts;
that eloquence has incomparable force and beauty; that poesy has
its ravishing graces and delights; that in the mathematics there are
many refined discoveries eminently suited to gratify the inquisitive, as well as further all the arts an lessen the labour of man; that numerous highly useful precepts and exhortations to virtue are contained in treatises on morals; that theology points out the path to heaven; that philosophy affords the means of discoursing with an appearance of truth on all matters, and commands the admiration of the more simple; that jurisprudence, medicine, and the other sciences, secure for their cultivators honors and riches; and, in fine, that it is useful to bestow some attention upon all, even upon those abounding the most in superstition and error, that we may be in a position to determine their real value, and guard against being deceived.

But I believed that I had already given sufficient time to languages, and likewise to the reading of the writings of the ancients, to their histories and fables. For to hold converse with those of other ages and to travel, are almost the same thing. It is useful to know something of the manners of different nations, that we may be enabled to form a more correct judgment regarding our own, and be prevented from thinking that everything contrary to our customs is ridiculous and irrational, a conclusion usually come to by those whose experience has been limited to their own country. On the other hand, when too much time is occupied in traveling, we become strangers to our native country; and the over curious in the customs of the past are generally ignorant of those of the present. Besides, fictitious narratives lead us to imagine the possibility of many events that are impossible; and even the most faithful histories, if they do not wholly misrepresent matters, or exaggerate their importance to render the account of them more worthy of perusal, omit, at least, almost always the meanest and least striking of the attendant circumstances; hence it happens that the remainder does not represent the truth, and that such as regulate their conduct by examples drawn from this source, are apt to fall into the extravagances of the knight-errants of romance, and to entertain projects that exceed their powers.

I esteemed eloquence highly, and was in raptures with poesy; but I thought that both were gifts of nature rather than fruits of study. Those in whom the faculty of reason is predominant, and who most skillfully dispose their thoughts with a view to render them clear and
intelligible, are always the best able to persuade others of the truth of
what they lay down, though they should speak only in the language of
Lower Brittany, and be wholly ignorant of the rules of rhetoric; and
those whose minds are stored with the most agreeable fancies, and
who can give expression to them with the greatest embellishment
and harmony, are still the best poets, though unacquainted with the
art of poetry.

I was especially delighted with the mathematics, on account of
the certitude and evidence of their reasonings; but I had not as yet a
precise knowledge of their true use; and thinking that they but con-
tributed to the advancement of the mechanical arts, I was astonished
that foundations, so strong and solid, should have had no loftier
superstructure reared on them. On the other hand, I compared the
disquisitions of the ancient moralists to very towering and magnificent
palaces with no better foundation than sand and mud: they laud the
virtues very highly, and exhibit them as estimable far above anything
on earth; but they give us no adequate criterion of virtue, and fre-
quently that which they designate with so fine a name is but apathy,
or pride, or despair, or parricide.

I revered our theology, and aspired as much as any one to reach
heaven: but being given assuredly to understand that the way is not
less open to the most ignorant than to the most learned, and that the
revealed truths which lead to heaven are above our comprehension, I
did not presume to subject them to the impotency of my reason; and
I thought that in order competently to undertake their examination,
there was need of some special help from heaven, and of being more
than man.

Of philosophy I will say nothing, except that when I saw that it had
been cultivated for many ages by the most distinguished men, and
that yet there is not a single matter within its sphere which is not still
in dispute, and nothing, therefore, which is above doubt, I did not
presume to anticipate that my success would be greater in it than that
of others; and further, when I considered the number of conflicting
opinions touching a single matter that may be upheld by learned
men, while there can be but one true, I reckoned as well-nigh false
all that was only probable.
As to the other sciences, inasmuch as these borrow their principles from philosophy, I judged that no solid superstructures could be reared on foundations so infirm; and neither the honor nor the gain held out by them was sufficient to determine me to their cultivation: for I was not, thank Heaven, in a condition which compelled me to make merchandise of science for the bettering of my fortune; and though I might not profess to scorn glory as a cynic, I yet made very slight account of that honor which I hoped to acquire only through fictitious titles. And, in fine, of false sciences I thought I knew the worth sufficiently to escape being deceived by the professions of an alchemist, the predictions of an astrologer, the impostures of a magician, or by the artifices and boasting of any of those who profess to know things of which they are ignorant.

For these reasons, as soon as my age permitted me to pass from under the control of my instructors, I entirely abandoned the study of letters, and resolved no longer to seek any other science than the knowledge of myself, or of the great book of the world. I spent the remainder of my youth in traveling, in visiting courts and armies, in holding intercourse with men of different dispositions and ranks, in collecting varied experience, in proving myself in the different situations into which fortune threw me, and, above all, in making such reflection on the matter of my experience as to secure my improvement. For it occurred to me that I should find much more truth in the reasonings of each individual with reference to the affairs in which he is personally interested, and the issue of which must presently punish him if he has judged amiss, than in those conducted by a man of letters in his study, regarding speculative matters that are of no practical moment, and followed by no consequences to himself, farther, perhaps, than that they foster his vanity the better the more remote they are from common sense; requiring, as they must in this case, the exercise of greater ingenuity and art to render them probable. In addition, I had always a most earnest desire to know how to distinguish the true from the false, in order that I might be able clearly to discriminate the right path in life, and proceed in it with confidence.

It is true that, while busied only in considering the manners of other men, I found here, too, scarce any ground for settled conviction, and
remarked hardly less contradiction among them than in the opinions of the philosophers. So that the greatest advantage I derived from the study consisted in this, that, observing many things which, however extravagant and ridiculous to our apprehension, are yet by common consent received and approved by other great nations, I learned to entertain too decided a belief in regard to nothing of the truth of which I had been persuaded merely by example and custom; and thus I gradually extricated myself from many errors powerful enough to darken our natural intelligence, and incapacitate us in great measure from listening to reason. But after I had been occupied several years in thus studying the book of the world, and in essaying to gather some experience, I at length resolved to make myself an object of study, and to employ all the powers of my mind in choosing the paths I ought to follow, an undertaking which was accompanied with greater success than it would have been had I never quitted my country or my books.
PART II

I was then in Germany, attracted thither by the wars in that country, which have not yet been brought to a termination; and as I was returning to the army from the coronation of the emperor, the setting in of winter arrested me in a locality where, as I found no society to interest me, and was besides fortunately undisturbed by any cares or passions, I remained the whole day in seclusion, with full opportunity to occupy my attention with my own thoughts. Of these one of the very first that occurred to me was, that there is seldom so much perfection in works composed of many separate parts, upon which different hands had been employed, as in those completed by a single master. Thus it is observable that the buildings which a single architect has planned and executed, are generally more elegant and commodious than those which several have attempted to improve, by making old walls serve for purposes for which they were not originally built. Thus also, those ancient cities which, from being at first only villages, have become, in course of time, large towns, are usually but ill laid out compared with the regularity constructed towns which a professional architect has freely planned on an open plain; so that although the several buildings of the former may often equal or surpass in beauty those of the latter, yet when one observes their indiscriminate juxtaposition, there a large one and here a small, and the consequent crookedness and irregularity of the streets, one is disposed to allege that chance rather than any human will guided by reason must have led to such an arrangement. And if we consider that nevertheless there have been at all times certain officers whose duty it was to see that private buildings contributed to public ornament, the difficulty
of reaching high perfection with but the materials of others to operate on, will be readily acknowledged. In the same way I fancied that those nations which, starting from a semi-barbarous state and advancing to civilization by slow degrees, have had their laws successively determined, and, as it were, forced upon them simply by experience of the hurtfulness of particular crimes and disputes, would by this process come to be possessed of less perfect institutions than those which, from the commencement of their association as communities, have followed the appointments of some wise legislator. It is thus quite certain that the constitution of the true religion, the ordinances of which are derived from God, must be incomparably superior to that of every other. And, to speak of human affairs, I believe that the pre-eminence of Sparta was due not to the goodness of each of its laws in particular, for many of these were very strange, and even opposed to good morals, but to the circumstance that, originated by a single individual, they all tended to a single end. In the same way I thought that the sciences contained in books (such of them at least as are made up of probable reasonings, without demonstrations), composed as they are of the opinions of many different individuals massed together, are farther removed from truth than the simple inferences which a man of good sense using his natural and unprejudiced judgment draws respecting the matters of his experience. And because we have all to pass through a state of infancy to manhood, and have been of necessity, for a length of time, governed by our desires and preceptors (whose dictates were frequently conflicting, while neither perhaps always counseled us for the best), I farther concluded that it is almost impossible that our judgments can be so correct or solid as they would have been, had our reason been mature from the moment of our birth, and had we always been guided by it alone.

It is true, however, that it is not customary to pull down all the houses of a town with the single design of rebuilding them differently, and thereby rendering the streets more handsome; but it often happens that a private individual takes down his own with the view of erecting it anew, and that people are even sometimes constrained to this when their houses are in danger of falling from age, or when the foundations are insecure. With this before me by way of example,
I was persuaded that it would indeed be preposterous for a private individual to think of reforming a state by fundamentally changing it throughout, and overturning it in order to set it up amended; and the same I thought was true of any similar project for reforming the body of the sciences, or the order of teaching them established in the schools: but as for the opinions which up to that time I had embraced, I thought that I could not do better than resolve at once to sweep them wholly away, that I might afterwards be in a position to admit either others more correct, or even perhaps the same when they had undergone the scrutiny of reason. I firmly believed that in this way I should much better succeed in the conduct of my life, than if I built only upon old foundations, and leaned upon principles which, in my youth, I had taken upon trust. For although I recognized various difficulties in this undertaking, these were not, however, without remedy, nor once to be compared with such as attend the slightest reformation in public affairs. Large bodies, if once overthrown, are with great difficulty set up again, or even kept erect when once seriously shaken, and the fall of such is always disastrous. Then if there are any imperfections in the constitutions of states (and that many such exist the diversity of constitutions is alone sufficient to assure us), custom has without doubt materially smoothed their inconveniences, and has even managed to steer altogether clear of, or insensibly corrected a number which sagacity could not have provided against with equal effect; and, in fine, the defects are almost always more tolerable than the change necessary for their removal; in the same manner that highways which wind among mountains, by being much frequented, become gradually so smooth and commodious, that it is much better to follow them than to seek a straighter path by climbing over the tops of rocks and descending to the bottoms of precipices.

Hence it is that I cannot in any degree approve of those restless and busy meddlers who, called neither by birth nor fortune to take part in the management of public affairs, are yet always projecting reforms; and if I thought that this tract contained aught which might justify the suspicion that I was a victim of such folly, I would by no means permit its publication. I have never contemplated anything higher than the reformation of my own opinions, and basing them
on a foundation wholly my own. And although my own satisfaction with my work has led me to present here a draft of it, I do not by any means therefore recommend to every one else to make a similar attempt. Those whom God has endowed with a larger measure of genius will entertain, perhaps, designs still more exalted; but for the many I am much afraid lest even the present undertaking be more than they can safely venture to imitate. The single design to strip one’s self of all past beliefs is one that ought not to be taken by every one. The majority of men is composed of two classes, for neither of which would this be at all a befitting resolution: in the first place, of those who with more than a due confidence in their own powers, are precipitate in their judgments and want the patience requisite for orderly and circumspect thinking; whence it happens, that if men of this class once take the liberty to doubt of their accustomed opinions, and quit the beaten highway, they will never be able to thread the byway that would lead them by a shorter course, and will lose themselves and continue to wander for life; in the second place, of those who, possessed of sufficient sense or modesty to determine that there are others who excel them in the power of discriminating between truth and error, and by whom they may be instructed, ought rather to content themselves with the opinions of such than trust for more correct to their own reason.

For my own part, I should doubtless have belonged to the latter class, had I received instruction from but one master, or had I never known the diversities of opinion that from time immemorial have prevailed among men of the greatest learning. But I had become aware, even so early as during my college life, that no opinion, however absurd and incredible, can be imagined, which has not been maintained by some one of the philosophers; and afterwards in the course of my travels I remarked that all those whose opinions are decidedly repugnant to ours are not in that account barbarians and savages, but on the contrary that many of these nations make an equally good, if not better, use of their reason than we do. I took into account also the very different character which a person brought up from infancy in France or Germany exhibits, from that which, with the same mind originally, this individual would have possessed had he lived always
among the Chinese or with savages, and the circumstance that in
dress itself the fashion which pleased us ten years ago, and which may
again, perhaps, be received into favor before ten years have gone,
appears to us at this moment extravagant and ridiculous. I was thus
led to infer that the ground of our opinions is far more custom and
example than any certain knowledge. And, finally, although such be
the ground of our opinions, I remarked that a plurality of suffrages
is no guarantee of truth where it is at all of difficult discovery, as in
such cases it is much more likely that it will be found by one than by
many. I could, however, select from the crowd no one whose opinions
seemed worthy of preference, and thus I found myself constrained,
as it were, to use my own reason in the conduct of my life.

But like one walking alone and in the dark, I resolved to proceed
so slowly and with such circumspection, that if I did not advance far,
I would at least guard against falling. I did not even choose to dismiss
summarily any of the opinions that had crept into my belief without
having been introduced by reason, but first of all took sufficient time
carefully to satisfy myself of the general nature of the task I was set-
ting myself, and ascertain the true method by which to arrive at the
knowledge of whatever lay within the compass of my powers.

Among the branches of philosophy, I had, at an earlier period,
given some attention to logic, and among those of the mathemat-
ics to geometrical analysis and algebra,—three arts or sciences which
ought, as I conceived, to contribute something to my design. But, on
examination, I found that, as for logic, its syllogisms and the major-
ity of its other precepts are of avail—rather in the communication of
what we already know, or even as the art of Lully, in speaking without
judgment of things of which we are ignorant, than in the investi-
gation of the unknown; and although this science contains indeed
a number of correct and very excellent precepts, there are, never-
theless, so many others, and these either injurious or superfluous,
mingled with the former, that it is almost quite as difficult to effect
a severance of the true from the false as it is to extract a Diana or a
Minerva from a rough block of marble. Then as to the analysis of the
ancients and the algebra of the moderns, besides that they embrace
only matters highly abstract, and, to appearance, of no use, the former
is so exclusively restricted to the consideration of figures, that it can exercise the understanding only on condition of greatly fatiguing the imagination; and, in the latter, there is so complete a subjection to certain rules and formulas, that there results an art full of confusion and obscurity calculated to embarrass, instead of a science fitted to cultivate the mind. By these considerations I was induced to seek some other method which would comprise the advantages of the three and be exempt from their defects. And as a multitude of laws often only hampers justice, so that a state is best governed when, with few laws, these are rigidly administered; in like manner, instead of the great number of precepts of which logic is composed, I believed that the four following would prove perfectly sufficient for me, provided I took the firm and unwavering resolution never in a single instance to fail in observing them.

The first was never to accept anything for true which I did not clearly know to be such; that is to say, carefully to avoid precipitancy and prejudice, and to comprise nothing more in my judgement than what was presented to my mind so clearly and distinctly as to exclude all ground of doubt.

The second, to divide each of the difficulties under examination into as many parts as possible, and as might be necessary for its adequate solution.

The third, to conduct my thoughts in such order that, by commencing with objects the simplest and easiest to know, I might ascend by little and little, and, as it were, step by step, to the knowledge of the more complex; assigning in thought a certain order even to those objects which in their own nature do not stand in a relation of antecedence and sequence.

And the last, in every case to make enumerations so complete, and reviews so general, that I might be assured that nothing was omitted.

The long chains of simple and easy reasonings by means of which geometers are accustomed to reach the conclusions of their most difficult demonstrations, had led me to imagine that all things, to the knowledge of which man is competent, are mutually connected in the same way, and that there is nothing so far removed from us as to be beyond our reach, or so hidden that we cannot discover it,
provided only we abstain from accepting the false for the true, and always preserve in our thoughts the order necessary for the deduction of one truth from another. And I had little difficulty in determining the objects with which it was necessary to commence, for I was already persuaded that it must be with the simplest and easiest to know, and, considering that of all those who have hitherto sought truth in the sciences, the mathematicians alone have been able to find any demonstrations, that is, any certain and evident reasons, I did not doubt but that such must have been the rule of their investigations. I resolved to commence, therefore, with the examination of the simplest objects, not anticipating, however, from this any other advantage than that to be found in accustoming my mind to the love and nourishment of truth, and to a distaste for all such reasonings as were unsound. But I had no intention on that account of attempting to master all the particular sciences commonly denominated mathematics: but observing that, however different their objects, they all agree in considering only the various relations or proportions subsisting among those objects, I thought it best for my purpose to consider these proportions in the most general form possible, without referring them to any objects in particular, except such as would most facilitate the knowledge of them, and without by any means restricting them to these, that afterwards I might thus be the better able to apply them to every other class of objects to which they are legitimately applicable. Perceiving further, that in order to understand these relations I should sometimes have to consider them one by one and sometimes only to bear them in mind, or embrace them in the aggregate, I thought that, in order the better to consider them individually, I should view them as subsisting between straight lines, than which I could find no objects more simple, or capable of being more distinctly represented to my imagination and senses; and on the other hand, that in order to retain them in the memory or embrace an aggregate of many, I should express them by certain characters the briefest possible. In this way I believed that I could borrow all that was best both in geometrical analysis and in algebra, and correct all the defects of the one by help of the other.

And, in point of fact, the accurate observance of these few precepts gave me, I take the liberty of saying, such ease in unraveling all the
questions embraced in these two sciences, that in the two or three months I devoted to their examination, not only did I reach solutions of questions I had formerly deemed exceedingly difficult but even as regards questions of the solution of which I continued ignorant, I was enabled, as it appeared to me, to determine the means whereby, and the extent to which a solution was possible; results attributable to the circumstance that I commenced with the simplest and most general truths, and that thus each truth discovered was a rule available in the discovery of subsequent ones. Nor in this perhaps shall I appear too vain, if it be considered that, as the truth on any particular point is one whoever apprehends the truth, knows all that on that point can be known. The child, for example, who has been instructed in the elements of arithmetic, and has made a particular addition, according to rule, may be assured that he has found, with respect to the sum of the numbers before him, and that in this instance is within the reach of human genius. Now, in conclusion, the method which teaches adherence to the true order, and an exact enumeration of all the conditions of the thing sought includes all that gives certitude to the rules of arithmetic.

But the chief ground of my satisfaction with this method, was the assurance I had of thereby exercising my reason in all matters, if not with absolute perfection, at least with the greatest attainable by me: besides, I was conscious that by its use my mind was becoming gradually habituated to clearer and more distinct conceptions of its objects; and I hoped also, from not having restricted this method to any particular matter, to apply it to the difficulties of the other sciences, with not less success than to those of algebra. I should not, however, on this account have ventured at once on the examination of all the difficulties of the sciences which presented themselves to me, for this would have been contrary to the order prescribed in the method, but observing that the knowledge of such is dependent on principles borrowed from philosophy, in which I found nothing certain, I thought it necessary first of all to endeavor to establish its principles. And because I observed, besides, that an inquiry of this kind was of all others of the greatest moment, and one in which precipitancy and anticipation in judgment were most to be dreaded,
I thought that I ought not to approach it till I had reached a more mature age (being at that time but twenty-three), and had first of all employed much of my time in preparation for the work, as well by eradicating from my mind all the erroneous opinions I had up to that moment accepted, as by amassing variety of experience to afford materials for my reasonings, and by continually exercising myself in my chosen method with a view to increased skill in its application.
PART III

And finally, as it is not enough, before commencing to rebuild the house in which we live, that it be pulled down, and materials and builders provided, or that we engage in the work ourselves, according to a plan which we have beforehand carefully drawn out, but as it is likewise necessary that we be furnished with some other house in which we may live commodiously during the operations, so that I might not remain irresolute in my actions, while my reason compelled me to suspend my judgement, and that I might not be prevented from living thenceforward in the greatest possible felicity, I formed a provisory code of morals, composed of three or four maxims, with which I am desirous to make you acquainted.

The first was to obey the laws and customs of my country, adhering firmly to the faith in which, by the grace of God, I had been educated from my childhood and regulating my conduct in every other matter according to the most moderate opinions, and the farthest removed from extremes, which should happen to be adopted in practice with general consent of the most judicious of those among whom I might be living. For as I had from that time begun to hold my own opinions for nought because I wished to subject them all to examination, I was convinced that I could not do better than follow in the meantime the opinions of the most judicious; and although there are some perhaps among the Persians and Chinese as judicious as among ourselves, expediency seemed to dictate that I should regulate my practice conformably to the opinions of those with whom I should have to live; and it appeared to me that, in order to ascertain the real opinions of such, I ought rather to take cognizance of what they practised than
of what they said, not only because, in the corruption of our manners, there are few disposed to speak exactly as they believe, but also because very many are not aware of what it is that they really believe; for, as the act of mind by which a thing is believed is different from that by which we know that we believe it, the one act is often found without the other. Also, amid many opinions held in equal repute, I chose always the most moderate, as much for the reason that these are always the most convenient for practice, and probably the best (for all excess is generally vicious), as that, in the event of my falling into error, I might be at less distance from the truth than if, having chosen one of the extremes, it should turn out to be the other which I ought to have adopted. And I placed in the class of extremes especially all promises by which somewhat of our freedom is abridged; not that I disapproved of the laws which, to provide against the instability of men of feeble resolution, when what is sought to be accomplished is some good, permit engagements by vows and contracts binding the parties to persevere in it, or even, for the security of commerce, sanction similar engagements where the purpose sought to be realized is indifferent: but because I did not find anything on earth which was wholly superior to change, and because, for myself in particular, I hoped gradually to perfect my judgments, and not to suffer them to deteriorate, I would have deemed it a grave sin against good sense, if, for the reason that I approved of something at a particular time, I therefore bound myself to hold it for good at a subsequent time, when perhaps it had ceased to be so, or I had ceased to esteem it such.

My second maxim was to be as firm and resolute in my actions as I was able, and not to adhere less steadfastly to the most doubtful opinions, when once adopted, than if they had been highly certain; imitating in this the example of travelers who, when they have lost their way in a forest, ought not to wander from side to side, far less remain in one place, but proceed constantly towards the same side in as straight a line as possible, without changing their direction for slight reasons, although perhaps it might be chance alone which at first determined the selection; for in this way, if they do not exactly reach the point they desire, they will come at least in the end to some place that will probably be preferable to the middle of a forest. In the
same way, since in action it frequently happens that no delay is permissible, it is very certain that, when it is not in our power to determine what is true, we ought to act according to what is most probable; and even although we should not remark a greater probability in one opinion than in another, we ought notwithstanding to choose one or the other, and afterwards consider it, in so far as it relates to practice, as no longer dubious, but manifestly true and certain, since the reason by which our choice has been determined is itself possessed of these qualities. This principle was sufficient thenceforward to rid me of all those repentings and pangs of remorse that usually disturb the consciences of such feeble and uncertain minds as, destitute of any clear and determinate principle of choice, allow themselves one day to adopt a course of action as the best, which they abandon the next, as the opposite.

My third maxim was to endeavor always to conquer myself rather than fortune, and change my desires rather than the order of the world, and in general, accustom myself to the persuasion that, except our own thoughts, there is nothing absolutely in our power; so that when we have done our best in things external to us, all wherein we fail of success is to be held, as regards us, absolutely impossible: and this single principle seemed to me sufficient to prevent me from desiring for the future anything which I could not obtain, and thus render me contented; for since our will naturally seeks those objects alone which the understanding represents as in some way possible of attainment, it is plain, that if we consider all external goods as equally beyond our power, we shall no more regret the absence of such goods as seem due to our birth, when deprived of them without any fault of ours, than our not possessing the kingdoms of China or Mexico, and thus making, so to speak, a virtue of necessity, we shall no more desire health in disease, or freedom in imprisonment, than we now do bodies incorruptible as diamonds, or the wings of birds to fly with. But I confess there is need of prolonged discipline and frequently repeated meditation to accustom the mind to view all objects in this light; and I believe that in this chiefly consisted the secret of the power of such philosophers as in former times were enabled to rise superior to the influence of fortune, and, amid suffering and poverty, enjoy a
happiness which their gods might have envied. For, occupied incessantly with the consideration of the limits prescribed to their power by nature, they became so entirely convinced that nothing was at their disposal except their own thoughts, that this conviction was of itself sufficient to prevent their entertaining any desire of other objects; and over their thoughts they acquired a sway so absolute, that they had some ground on this account for esteeming themselves more rich and more powerful, more free and more happy, than other men who, whatever be the favors heaped on them by nature and fortune, if destitute of this philosophy, can never command the realization of all their desires.

In fine, to conclude this code of morals, I thought of reviewing the different occupations of men in this life, with the view of making choice of the best. And, without wishing to offer any remarks on the employments of others, I may state that it was my conviction that I could not do better than continue in that in which I was engaged, viz., in devoting my whole life to the culture of my reason, and in making the greatest progress I was able in the knowledge of truth, on the principles of the method which I had prescribed to myself. This method, from the time I had begun to apply it, had been to me the source of satisfaction so intense as to lead me to, believe that more perfect or more innocent could not be enjoyed in this life; and as by its means I daily discovered truths that appeared to me of some importance, and of which other men were generally ignorant, the gratification thence arising so occupied my mind that I was wholly indifferent to every other object. Besides, the three preceding maxims were founded singly on the design of continuing the work of self-instruction. For since God has endowed each of us with some light of reason by which to distinguish truth from error, I could not have believed that I ought for a single moment to rest satisfied with the opinions of another, unless I had resolved to exercise my own judgment in examining these whenever I should be duly qualified for the task. Nor could I have proceeded on such opinions without scruple, had I supposed that I should thereby forfeit any advantage for attaining still more accurate, should such exist. And, in fine, I could not have restrained my desires, nor remained satisfied had I
not followed a path in which I thought myself certain of attaining all
the knowledge to the acquisition of which I was competent, as well
as the largest amount of what is truly good which I could ever hope
to secure. Inasmuch as we neither seek nor shun any object except in
so far as our understanding represents it as good or bad, all that is
necessary to right action is right judgment, and to the best action the
most correct judgment, that is, to the acquisition of all the virtues with
all else that is truly valuable and within our reach; and the assurance
of such an acquisition cannot fail to render us contented.

Having thus provided myself with these maxims, and having
placed them in reserve along with the truths of faith, which have ever
occupied the first place in my belief, I came to the conclusion that I
might with freedom set about ridding myself of what remained of my
opinions. And, inasmuch as I hoped to be better able successfully to
accomplish this work by holding intercourse with mankind, than by
remaining longer shut up in the retirement where these thoughts had
occurred to me, I betook me again to traveling before the winter was
well ended. And, during the nine subsequent years, I did nothing but
roam from one place to another, desirous of being a spectator rather
than an actor in the plays exhibited on the theater of the world; and,
as I made it my business in each matter to reflect particularly upon
what might fairly be doubted and prove a source of error, I gradually
rooted out from my mind all the errors which had hitherto crept into
it. Not that in this I imitated the sceptics who doubt only that they may
doubt, and seek nothing beyond uncertainty itself; for, on the con-
trary, my design was singly to find ground of assurance, and cast aside
the loose earth and sand, that I might reach the rock or the clay. In
this, as appears to me, I was successful enough; for, since I endeavored
to discover the falsehood or incertitude of the propositions I exam-
ined, not by feeble conjectures, but by clear and certain reasonings,
I met with nothing so doubtful as not to yield some conclusion of
adequate certainty, although this were merely the inference, that the
matter in question contained nothing certain. And, just as in pulling
down an old house, we usually reserve the ruins to contribute towards
the erection, so, in destroying such of my opinions as I judged to be
ill-founded, I made a variety of observations and acquired an amount
of experience of which I availed myself in the establishment of more certain. And further, I continued to exercise myself in the method I had prescribed; for, besides taking care in general to conduct all my thoughts according to its rules, I reserved some hours from time to time which I expressly devoted to the employment of the method in the solution of mathematical difficulties, or even in the solution likewise of some questions belonging to other sciences, but which, by my having detached them from such principles of these sciences as were of inadequate certainty, were rendered almost mathematical: the truth of this will be manifest from the numerous examples contained in this volume. And thus, without in appearance living otherwise than those who, with no other occupation than that of spending their lives agreeably and innocently, study to sever pleasure from vice, and who, that they may enjoy their leisure without ennui, have recourse to such pursuits as are honorable, I was nevertheless prosecuting my design, and making greater progress in the knowledge of truth, than I might, perhaps, have made had I been engaged in the perusal of books merely, or in holding converse with men of letters.

These nine years passed away, however, before I had come to any determinate judgment respecting the difficulties which form matter of dispute among the learned, or had commenced to seek the principles of any philosophy more certain than the vulgar. And the examples of many men of the highest genius, who had, in former times, engaged in this inquiry, but, as appeared to me, without success, led me to imagine it to be a work of so much difficulty, that I would not perhaps have ventured on it so soon had I not heard it currently rumored that I had already completed the inquiry. I know not what were the grounds of this opinion; and, if my conversation contributed in any measure to its rise, this must have happened rather from my having confessed my Ignorance with greater freedom than those are accustomed to do who have studied a little, and expounded perhaps, the reasons that led me to doubt of many of those things that by others are esteemed certain, than from my having boasted of any system of philosophy. But, as I am of a disposition that makes me unwilling to be esteemed different from what I really am, I thought it necessary to endeavor by all means to render myself worthy of the reputation
accorded to me; and it is now exactly eight years since this desire constrained me to remove from all those places where interruption from any of my acquaintances was possible, and betake myself to this country, in which the long duration of the war has led to the establishment of such discipline, that the armies maintained seem to be of use only in enabling the inhabitants to enjoy more securely the blessings of peace and where, in the midst of a great crowd actively engaged in business, and more careful of their own affairs than curious about those of others, I have been enabled to live without being deprived of any of the conveniences to be had in the most populous cities, and yet as solitary and as retired as in the midst of the most remote deserts.
PART IV

I am in doubt as to the propriety of making my first meditations in the place above mentioned matter of discourse; for these are so metaphysical, and so uncommon, as not, perhaps, to be acceptable to every one. And yet, that it may be determined whether the foundations that I have laid are sufficiently secure, I find myself in a measure constrained to advert to them. I had long before remarked that, in relation to practice, it is sometimes necessary to adopt, as if above doubt, opinions which we discern to be highly uncertain, as has been already said; but as I then desired to give my attention solely to the search after truth, I thought that a procedure exactly the opposite was called for, and that I ought to reject as absolutely false all opinions in regard to which I could suppose the least ground for doubt, in order to ascertain whether after that there remained aught in my belief that was wholly indubitable. Accordingly, seeing that our senses sometimes deceive us, I was willing to suppose that there existed nothing really such as they presented to us; and because some men err in reasoning, and fall into paralogisms, even on the simplest matters of geometry, I, convinced that I was as open to error as any other, rejected as false all the reasonings I had hitherto taken for demonstrations; and finally, when I considered that the very same thoughts (presentations) which we experience when awake may also be experienced when we are asleep, while there is at that time not one of them true, I supposed that all the objects (presentations) that had ever entered into my mind when awake, had in them no more truth than the illusions of my dreams. But immediately upon this I observed that, whilst I thus wished to think that all was false, it was
absolutely necessary that I, who thus thought, should be somewhat; and as I observed that this truth, I think, therefore I am (COGITO ERGO SUM), was so certain and of such evidence that no ground of doubt, however extravagant, could be alleged by the sceptics capable of shaking it, I concluded that I might, without scruple, accept it as the first principle of the philosophy of which I was in search.

In the next place, I attentively examined what I was and as I observed that I could suppose that I had no body, and that there was no world nor any place in which I might be; but that I could not therefore suppose that I was not; and that, on the contrary, from the very circumstance that I thought to doubt of the truth of other things, it most clearly and certainly followed that I was; while, on the other hand, if I had only ceased to think, although all the other objects which I had ever imagined had been in reality existent, I would have had no reason to believe that I existed; I thence concluded that I was a substance whose whole essence or nature consists only in thinking, and which, that it may exist, has need of no place, nor is dependent on any material thing; so that “I,” that is to say, the mind by which I am what I am, is wholly distinct from the body, and is even more easily known than the latter, and is such, that although the latter were not, it would still continue to be all that it is.

After this I inquired in general into what is essential to the truth and certainty of a proposition; for since I had discovered one which I knew to be true, I thought that I must likewise be able to discover the ground of this certitude. And as I observed that in the words I think, therefore I am, there is nothing at all which gives me assurance of their truth beyond this, that I see very clearly that in order to think it is necessary to exist, I concluded that I might take, as a general rule, the principle, that all the things which we very clearly and distinctly conceive are true, only observing, however, that there is some difficulty in rightly determining the objects which we distinctly conceive.

In the next place, from reflecting on the circumstance that I doubted, and that consequently my being was not wholly perfect (for I clearly saw that it was a greater perfection to know than to doubt), I was led to inquire whence I had learned to think of something more perfect than myself; and I clearly recognized that I must hold this
notion from some nature which in reality was more perfect. As for the thoughts of many other objects external to me, as of the sky, the earth, light, heat, and a thousand more, I was less at a loss to know whence these came; for since I remarked in them nothing which seemed to render them superior to myself, I could believe that, if these were true, they were dependencies on my own nature, in so far as it possessed a certain perfection, and, if they were false, that I held them from nothing, that is to say, that they were in me because of a certain imperfection of my nature. But this could not be the case with the idea of a nature more perfect than myself; for to receive it from nothing was a thing manifestly impossible; and, because it is not less repugnant that the more perfect should be an effect of, and dependence on the less perfect, than that something should proceed from nothing, it was equally impossible that I could hold it from myself: accordingly, it but remained that it had been placed in me by a nature which was in reality more perfect than mine, and which even possessed within itself all the perfections of which I could form any idea; that is to say, in a single word, which was God. And to this I added that, since I knew some perfections which I did not possess, I was not the only being in existence (I will here, with your permission, freely use the terms of the schools); but, on the contrary, that there was of necessity some other more perfect Being upon whom I was dependent, and from whom I had received all that I possessed; for if I had existed alone, and independently of every other being, so as to have had from myself all the perfection, however little, which I actually possessed, I should have been able, for the same reason, to have had from myself the whole remainder of perfection, of the want of which I was conscious, and thus could of myself have become infinite, eternal, immutable, omniscient, all-powerful, and, in fine, have possessed all the perfections which I could recognize in God. For in order to know the nature of God (whose existence has been established by the preceding reasonings), as far as my own nature permitted, I had only to consider in reference to all the properties of which I found in my mind some idea, whether their possession was a mark of perfection; and I was assured that no one which indicated any imperfection was in him, and that none of the rest was wanting.
Thus I perceived that doubt, inconstancy, sadness, and such like, could not be found in God, since I myself would have been happy to be free from them. Besides, I had ideas of many sensible and corporeal things; for although I might suppose that I was dreaming, and that all which I saw or imagined was false, I could not, nevertheless, deny that the ideas were in reality in my thoughts. But, because I had already very clearly recognized in myself that the intelligent nature is distinct from the corporeal, and as I observed that all composition is an evidence of dependency, and that a state of dependency is manifestly a state of imperfection, I therefore determined that it could not be a perfection in God to be compounded of these two natures and that consequently he was not so compounded; but that if there were any bodies in the world, or even any intelligences, or other natures that were not wholly perfect, their existence depended on his power in such a way that they could not subsist without him for a single moment.

I was disposed straightway to search for other truths and when I had represented to myself the object of the geometers, which I conceived to be a continuous body or a space indefinitely extended in length, breadth, and height or depth, divisible into divers parts which admit of different figures and sizes, and of being moved or transposed in all manner of ways (for all this the geometers suppose to be in the object they contemplate), I went over some of their simplest demonstrations. And, in the first place, I observed, that the great certitude which by common consent is accorded to these demonstrations, is founded solely upon this, that they are clearly conceived in accordance with the rules I have already laid down In the next place, I perceived that there was nothing at all in these demonstrations which could assure me of the existence of their object: thus, for example, supposing a triangle to be given, I distinctly perceived that its three angles were necessarily equal to two right angles, but I did not on that account perceive anything which could assure me that any triangle existed: while, on the contrary, recurring to the examination of the idea of a Perfect Being, I found that the existence of the Being was comprised in the idea in the same way that the equality of its three angles to two right angles is comprised in the idea of a triangle, or as
in the idea of a sphere, the equidistance of all points on its surface from the center, or even still more clearly; and that consequently it is at least as certain that God, who is this Perfect Being, is, or exists, as any demonstration of geometry can be.

But the reason which leads many to persuade them selves that there is a difficulty in knowing this truth, and even also in knowing what their mind really is, is that they never raise their thoughts above sensible objects, and are so accustomed to consider nothing except by way of imagination, which is a mode of thinking limited to material objects, that all that is not imaginable seems to them not intelligible. The truth of this is sufficiently manifest from the single circumstance, that the philosophers of the schools accept as a maxim that there is nothing in the understanding which was not previously in the senses, in which however it is certain that the ideas of God and of the soul have never been; and it appears to me that they who make use of their imagination to comprehend these ideas do exactly the same thing as if, in order to hear sounds or smell odors, they strove to avail themselves of their eyes; unless indeed that there is this difference, that the sense of sight does not afford us an inferior assurance to those of smell or hearing; in place of which, neither our imagination nor our senses can give us assurance of anything unless our understanding intervene.

Finally, if there be still persons who are not sufficiently persuaded of the existence of God and of the soul, by the reasons I have adduced, I am desirous that they should know that all the other propositions, of the truth of which they deem themselves perhaps more assured, as that we have a body, and that there exist stars and an earth, and such like, are less certain; for, although we have a moral assurance of these things, which is so strong that there is an appearance of extravagance in doubting of their existence, yet at the same time no one, unless his intellect is impaired, can deny, when the question relates to a metaphysical certitude, that there is sufficient reason to exclude entire assurance, in the observation that when asleep we can in the same way imagine ourselves possessed of another body and that we see other stars and another earth, when there is nothing of the kind. For how do we know that the thoughts which occur in dreaming are false rather than those other which we experience when awake, since
the former are often not less vivid and distinct than the latter? And though men of the highest genius study this question as long as they please, I do not believe that they will be able to give any reason which can be sufficient to remove this doubt, unless they presuppose the existence of God. For, in the first place even the principle which I have already taken as a rule, viz., that all the things which we clearly and distinctly conceive are true, is certain only because God is or exists and because he is a Perfect Being; and because all that we possess is derived from him: whence it follows that our ideas or notions, which to the extent of their clearness and distinctness are real, and proceed from God, must to that extent be true. Accordingly, whereas we not infrequently have ideas or notions in which some falsity is contained, this can only be the case with such as are to some extent confused and obscure, and in this proceed from nothing (participate of negation), that is, exist in us thus confused because we are not wholly perfect. And it is evident that it is not less repugnant that falsity or imperfection, in so far as it is imperfection, should proceed from God, than that truth or perfection should proceed from nothing. But if we did not know that all which we possess of real and true proceeds from a Perfect and Infinite Being, however clear and distinct our ideas might be, we should have no ground on that account for the assurance that they possessed the perfection of being true.

But after the knowledge of God and of the soul has rendered us certain of this rule, we can easily understand that the truth of the thoughts we experience when awake, ought not in the slightest degree to be called in question on account of the illusions of our dreams. For if it happened that an individual, even when asleep, had some very distinct idea, as, for example, if a geometer should discover some new demonstration, the circumstance of his being asleep would not militate against its truth; and as for the most ordinary error of our dreams, which consists in their representing to us various objects in the same way as our external senses, this is not prejudicial, since it leads us very properly to suspect the truth of the ideas of sense; for we are not infrequently deceived in the same manner when awake; as when persons in the jaundice see all objects yellow, or when the stars or bodies at a great distance appear to us much smaller than
they are. For, in fine, whether awake or asleep, we ought never to allow ourselves to be persuaded of the truth of anything unless on the evidence of our reason. And it must be noted that I say of our reason, and not of our imagination or of our senses: thus, for example, although we very clearly see the sun, we ought not therefore to determine that it is only of the size which our sense of sight presents; and we may very distinctly imagine the head of a lion joined to the body of a goat, without being therefore shut up to the conclusion that a chimaera exists; for it is not a dictate of reason that what we thus see or imagine is in reality existent; but it plainly tells us that all our ideas or notions contain in them some truth; for otherwise it could not be that God, who is wholly perfect and veracious, should have placed them in us. And because our reasonings are never so clear or so complete during sleep as when we are awake, although sometimes the acts of our imagination are then as lively and distinct, if not more so than in our waking moments, reason further dictates that, since all our thoughts cannot be true because of our partial imperfection, those possessing truth must infallibly be found in the experience of our waking moments rather than in that of our dreams.
PART V

I would here willingly have proceeded to exhibit the whole chain of truths which I deduced from these primary but as with a view to this it would have been necessary now to treat of many questions in dispute among the learned, with whom I do not wish to be embroiled, I believe that it will be better for me to refrain from this exposition, and only mention in general what these truths are, that the more judicious may be able to determine whether a more special account of them would conduce to the public advantage. I have ever remained firm in my original resolution to suppose no other principle than that of which I have recently availed myself in demonstrating the existence of God and of the soul, and to accept as true nothing that did not appear to me more clear and certain than the demonstrations of the geometers had formerly appeared; and yet I venture to state that not only have I found means to satisfy myself in a short time on all the principal difficulties which are usually treated of in philosophy, but I have also observed certain laws established in nature by God in such a manner, and of which he has impressed on our minds such notions, that after we have reflected sufficiently upon these, we cannot doubt that they are accurately observed in all that exists or takes place in the world and farther, by considering the concatenation of these laws, it appears to me that I have discovered many truths more useful and more important than all I had before learned, or even had expected to learn.

But because I have essayed to expound the chief of these discoveries in a treatise which certain considerations prevent me from publishing, I cannot make the results known more conveniently than by here giving a summary of the contents of this treatise. It was my design to
DISCOURSE ON METHOD

comprise in it all that, before I set myself to write it, I thought I knew of the nature of material objects. But like the painters who, finding themselves unable to represent equally well on a plain surface all the different faces of a solid body, select one of the chief, on which alone they make the light fall, and throwing the rest into the shade, allow them to appear only in so far as they can be seen while looking at the principal one; so, fearing lest I should not be able to compensate in my discourse all that was in my mind, I resolved to expound singly, though at considerable length, my opinions regarding light; then to take the opportunity of adding something on the sun and the fixed stars, since light almost wholly proceeds from them; on the heavens since they transmit it; on the planets, comets, and earth, since they reflect it; and particularly on all the bodies that are upon the earth, since they are either colored, or transparent, or luminous; and finally on man, since he is the spectator of these objects. Further, to enable me to cast this variety of subjects somewhat into the shade, and to express my judgment regarding them with greater freedom, without being necessitated to adopt or refute the opinions of the learned, I resolved to leave all the people here to their disputes, and to speak only of what would happen in a new world, if God were now to create somewhere in the imaginary spaces matter sufficient to compose one, and were to agitate variously and confusedly the different parts of this matter, so that there resulted a chaos as disordered as the poets ever feigned, and after that did nothing more than lend his ordinary concurrence to nature, and allow her to act in accordance with the laws which he had established. On this supposition, I, in the first place, described this matter, and essayed to represent it in such a manner that to my mind there can be nothing clearer and more intelligible, except what has been recently said regarding God and the soul; for I even expressly supposed that it possessed none of those forms or qualities which are so debated in the schools, nor in general anything the knowledge of which is not so natural to our minds that no one can so much as imagine himself ignorant of it. Besides, I have pointed out what are the laws of nature; and, with no other principle upon which to found my reasonings except the infinite perfection of God, I endeavored to demonstrate all those about which there could be
any room for doubt, and to prove that they are such, that even if God had created more worlds, there could have been none in which these laws were not observed. Thereafter, I showed how the greatest part of the matter of this chaos must, in accordance with these laws, dispose and arrange itself in such a way as to present the appearance of heavens; how in the meantime some of its parts must compose an earth and some planets and comets, and others a sun and fixed stars. And, making a digression at this stage on the subject of light, I expounded at considerable length what the nature of that light must be which is found in the sun and the stars, and how thence in an instant of time it traverses the immense spaces of the heavens, and how from the planets and comets it is reflected towards the earth. To this I likewise added much respecting the substance, the situation, the motions, and all the different qualities of these heavens and stars; so that I thought I had said enough respecting them to show that there is nothing observable in the heavens or stars of our system that must not, or at least may not appear precisely alike in those of the system which I described. I came next to speak of the earth in particular, and to show how, even though I had expressly supposed that God had given no weight to the matter of which it is composed, this should not prevent all its parts from tending exactly to its center; how with water and air on its surface, the disposition of the heavens and heavenly bodies, more especially of the moon, must cause a flow and ebb, like in all its circumstances to that observed in our seas, as also a certain current both of water and air from east to west, such as is likewise observed between the tropics; how the mountains, seas, fountains, and rivers might naturally be formed in it, and the metals produced in the mines, and the plants grow in the fields and in general, how all the bodies which are commonly denominated mixed or composite might be generated and, among other things in the discoveries alluded to inasmuch as besides the stars, I knew nothing except fire which produces light, I spared no pains to set forth all that pertains to its nature,—the manner of its production and support, and to explain how heat is sometimes found without light, and light without heat; to show how it can induce various colors upon different bodies and other diverse qualities; how it reduces some to a liquid state and
hardens others; how it can consume almost all bodies, or convert
them into ashes and smoke; and finally, how from these ashes, by the
mere intensity of its action, it forms glass: for as this transmutation of
ashes into glass appeared to me as wonderful as any other in nature, I
took a special pleasure in describing it. I was not, however, disposed,
from these circumstances, to conclude that this world had been cre-
ated in the manner I described; for it is much more likely that God
made it at the first such as it was to be. But this is certain, and an
opinion commonly received among theologians, that the action by
which he now sustains it is the same with that by which he originally
created it; so that even although he had from the beginning given it
no other form than that of chaos, provided only he had established
certain laws of nature, and had lent it his concurrence to enable it to
act as it is wont to do, it may be believed, without discredit to the mir-
acle of creation, that, in this way alone, things purely material might,
in course of time, have become such as we observe them at present;
and their nature is much more easily conceived when they are beheld
coming in this manner gradually into existence, than when they are
only considered as produced at once in a finished and perfect state.

From the description of inanimate bodies and plants, I passed to
animals, and particularly to man. But since I had not as yet sufficient
knowledge to enable me to treat of these in the same manner as of
the rest, that is to say, by deducing effects from their causes, and by
showing from what elements and in what manner nature must pro-
duce them, I remained satisfied with the supposition that God formed
the body of man wholly like to one of ours, as well in the external
shape of the members as in the internal conformation of the organs,
of the same matter with that I had described, and at first placed in it
no rational soul, nor any other principle, in room of the vegetative or
sensitive soul, beyond kindling in the heart one of those fires without
light, such as I had already described, and which I thought was not
different from the heat in hay that has been heaped together before
it is dry, or that which causes fermentation in new wines before they
are run clear of the fruit. For, when I examined the kind of functions
which might, as consequences of this supposition, exist in this body,
I found precisely all those which may exist in us independently of all
power of thinking, and consequently without being in any measure owing to the soul; in other words, to that part of us which is distinct from the body, and of which it has been said above that the nature distinctively consists in thinking, functions in which the animals void of reason may be said wholly to resemble us; but among which I could not discover any of those that, as dependent on thought alone, belong to us as men, while, on the other hand, I did afterwards discover these as soon as I supposed God to have created a rational soul, and to have annexed it to this body in a particular manner which I described.

But, in order to show how I there handled this matter, I mean here to give the explication of the motion of the heart and arteries, which, as the first and most general motion observed in animals, will afford the means of readily determining what should be thought of all the rest. And that there may be less difficulty in understanding what I am about to say on this subject, I advise those who are not versed in anatomy, before they commence the perusal of these observations, to take the trouble of getting dissected in their presence the heart of some large animal possessed of lungs (for this is throughout sufficiently like the human), and to have shown to them its two ventricles or cavities: in the first place, that in the right side, with which correspond two very ample tubes, viz., the hollow vein (vena cava), which is the principal receptacle of the blood, and the trunk of the tree, as it were, of which all the other veins in the body are branches; and the arterial vein (vena arteriosa), inappropriately so denominated, since it is in truth only an artery, which, taking its rise in the heart, is divided, after passing out from it, into many branches which presently disperse themselves all over the lungs; in the second place, the cavity in the left side, with which correspond in the same manner two canals in size equal to or larger than the preceding, viz., the venous artery (arteria venosa), likewise inappropriately thus designated, because it is simply a vein which comes from the lungs, where it is divided into many branches, interlaced with those of the arterial vein, and those of the tube called the windpipe, through which the air we breathe enters; and the great artery which, issuing from the heart, sends its branches all over the body. I should wish also that such persons were carefully shown the eleven pellicles which, like so many small valves, open and shut the
four orifices that are in these two cavities, viz., three at the entrance of the hollow veins where they are disposed in such a manner as by no means to prevent the blood which it contains from flowing into the right ventricle of the heart, and yet exactly to prevent its flowing out; three at the entrance to the arterial vein, which, arranged in a manner exactly the opposite of the former, readily permit the blood contained in this cavity to pass into the lungs, but hinder that contained in the lungs from returning to this cavity; and, in like manner, two others at the mouth of the venous artery, which allow the blood from the lungs to flow into the left cavity of the heart, but preclude its return; and three at the mouth of the great artery, which suffer the blood to flow from the heart, but prevent its reflux. Nor do we need to seek any other reason for the number of these pellicles beyond this that the orifice of the venous artery being of an oval shape from the nature of its situation, can be adequately closed with two, whereas the others being round are more conveniently closed with three. Besides, I wish such persons to observe that the grand artery and the arterial vein are of much harder and firmer texture than the venous artery and the hollow vein; and that the two last expand before entering the heart, and there form, as it were, two pouches denominated the auricles of the heart, which are composed of a substance similar to that of the heart itself; and that there is always more warmth in the heart than in any other part of the body—and finally, that this heat is capable of causing any drop of blood that passes into the cavities rapidly to expand and dilate, just as all liquors do when allowed to fall drop by drop into a highly heated vessel.

For, after these things, it is not necessary for me to say anything more with a view to explain the motion of the heart, except that when its cavities are not full of blood, into these the blood of necessity flows,—from the hollow vein into the right, and from the venous artery into the left; because these two vessels are always full of blood, and their orifices, which are turned towards the heart, cannot then be closed. But as soon as two drops of blood have thus passed, one into each of the cavities, these drops which cannot but be very large, because the orifices through which they pass are wide, and the vessels from which they come full of blood, are immediately rarefied, and dilated by the
heat they meet with. In this way they cause the whole heart to expand, and at the same time press home and shut the five small valves that are at the entrances of the two vessels from which they flow, and thus prevent any more blood from coming down into the heart, and becoming more and more rarefied, they push open the six small valves that are in the orifices of the other two vessels, through which they pass out, causing in this way all the branches of the arterial vein and of the grand artery to expand almost simultaneously with the heart which immediately thereafter begins to contract, as do also the arteries, because the blood that has entered them has cooled, and the six small valves close, and the five of the hollow vein and of the venous artery open anew and allow a passage to other two drops of blood, which cause the heart and the arteries again to expand as before. And, because the blood which thus enters into the heart passes through these two pouches called auricles, it thence happens that their motion is the contrary of that of the heart, and that when it expands they contract. But lest those who are ignorant of the force of mathematical demonstrations and who are not accustomed to distinguish true reasons from mere verisimilitudes, should venture, without examination, to deny what has been said, I wish it to be considered that the motion which I have now explained follows as necessarily from the very arrangement of the parts, which may be observed in the heart by the eye alone, and from the heat which may be felt with the fingers, and from the nature of the blood as learned from experience, as does the motion of a clock from the power, the situation, and shape of its counterweights and wheels.

But if it be asked how it happens that the blood in the veins, flowing in this way continually into the heart, is not exhausted, and why the arteries do not become too full, since all the blood which passes through the heart flows into them, I need only mention in reply what has been written by a physician of England, who has the honor of having broken the ice on this subject, and of having been the first to teach that there are many small passages at the extremities of the arteries, through which the blood received by them from the heart passes into the small branches of the veins, whence it again returns to the heart; so that its course amounts precisely to a perpetual circulation. Of this we have abundant proof in the ordinary experience of surgeons,
who, by binding the arm with a tie of moderate straitness above the part
where they open the vein, cause the blood to flow more copiously than
it would have done without any ligature; whereas quite the contrary
would happen were they to bind it below; that is, between the hand and
the opening, or were to make the ligature above the opening very tight.
For it is manifest that the tie, moderately straightened, while adequate
to hinder the blood already in the arm from returning towards the
heart by the veins, cannot on that account prevent new blood from
coming forward through the arteries, because these are situated below
the veins, and their coverings, from their greater consistency, are more
difficult to compress; and also that the blood which comes from the
heart tends to pass through them to the hand with greater force than
it does to return from the hand to the heart through the veins. And
since the latter current escapes from the arm by the opening made in
one of the veins, there must of necessity be certain passages below the
ligature, that is, towards the extremities of the arm through which it
can come thither from the arteries. This physician likewise abundantly
establishes what he has advanced respecting the motion of the blood,
from the existence of certain pellicles, so disposed in various places
along the course of the veins, in the manner of small valves, as not
to permit the blood to pass from the middle of the body towards the
extremities, but only to return from the extremities to the heart; and
farther, from experience which shows that all the blood which is in the
body may flow out of it in a very short time through a single artery that
has been cut, even although this had been closely tied in the immediate
neighborhood of the heart and cut between the heart and the ligature,
so as to prevent the supposition that the blood flowing out of it could
come from any other quarter than the heart.

But there are many other circumstances which evince that what I
have alleged is the true cause of the motion of the blood: thus, in the
first place, the difference that is observed between the blood which
flows from the veins, and that from the arteries, can only arise from
this, that being rarefied, and, as it were, distilled by passing through
the heart, it is thinner, and more vivid, and warmer immediately after
leaving the heart, in other words, when in the arteries, than it was a
short time before passing into either, in other words, when it was in
the veins; and if attention be given, it will be found that this difference is very marked only in the neighborhood of the heart; and is not so evident in parts more remote from it. In the next place, the consistency of the coats of which the arterial vein and the great artery are composed, sufficiently shows that the blood is impelled against them with more force than against the veins. And why should the left cavity of the heart and the great artery be wider and larger than the right cavity and the arterial vein, were it not that the blood of the venous artery, having only been in the lungs after it has passed through the heart, is thinner, and rarefies more readily, and in a higher degree, than the blood which proceeds immediately from the hollow vein? And what can physicians conjecture from feeling the pulse unless they know that according as the blood changes its nature it can be rarefied by the warmth of the heart, in a higher or lower degree, and more or less quickly than before? And if it be inquired how this heat is communicated to the other members, must it not be admitted that this is effected by means of the blood, which, passing through the heart, is there heated anew, and thence diffused over all the body? Whence it happens, that if the blood be withdrawn from any part, the heat is likewise withdrawn by the same means; and although the heart were as-hot as glowing iron, it would not be capable of warming the feet and hands as at present, unless it continually sent thither new blood. We likewise perceive from this, that the true use of respiration is to bring sufficient fresh air into the lungs, to cause the blood which flows into them from the right ventricle of the heart, where it has been rarefied and, as it were, changed into vapors, to become thick, and to convert it anew into blood, before it flows into the left cavity, without which process it would be unfit for the nourishment of the fire that is there. This receives confirmation from the circumstance, that it is observed of animals destitute of lungs that they have also but one cavity in the heart, and that in children who cannot use them while in the womb, there is a hole through which the blood flows from the hollow vein into the left cavity of the heart, and a tube through which it passes from the arterial vein into the grand artery without passing through the lung. In the next place, how could digestion be carried on in the stomach unless the heart communicated heat to it through the
arteries, and along with this certain of the more fluid parts of the blood, which assist in the dissolution of the food that has been taken in? Is not also the operation which converts the juice of food into blood easily comprehended, when it is considered that it is distilled by passing and repassing through the heart perhaps more than one or two hundred times in a day? And what more need be adduced to explain nutrition, and the production of the different humors of the body, beyond saying, that the force with which the blood, in being rarefied, passes from the heart towards the extremities of the arteries, causes certain of its parts to remain in the members at which they arrive, and there occupy the place of some others expelled by them; and that according to the situation, shape, or smallness of the pores with which they meet, some rather than others flow into certain parts, in the same way that some sieves are observed to act, which, by being variously perforated, serve to separate different species of grain? And, in the last place, what above all is here worthy of observation, is the generation of the animal spirits, which are like a very subtle wind, or rather a very pure and vivid flame which, continually ascending in great abundance from the heart to the brain, thence penetrates through the nerves into the muscles, and gives motion to all the members; so that to account for other parts of the blood which, as most agitated and penetrating, are the fittest to compose these spirits, proceeding towards the brain, it is not necessary to suppose any other cause, than simply, that the arteries which carry them thither proceed from the heart in the most direct lines, and that, according to the rules of mechanics which are the same with those of nature, when many objects tend at once to the same point where there is not sufficient room for all (as is the case with the parts of the blood which flow forth from the left cavity of the heart and tend towards the brain), the weaker and less agitated parts must necessarily be driven aside from that point by the stronger which alone in this way reach it I had expounded all these matters with sufficient minuteness in the treatise which I formerly thought of publishing. And after these, I had shown what must be the fabric of the nerves and muscles of the human body to give the animal spirits contained in it the power to move the members, as when we see heads shortly after they have been struck off still
move and bite the earth, although no longer animated; what changes must take place in the brain to produce waking, sleep, and dreams; how light, sounds, odors, tastes, heat, and all the other qualities of external objects impress it with different ideas by means of the senses; how hunger, thirst, and the other internal affections can likewise impress upon it divers ideas; what must be understood by the common sense (sensus communis) in which these ideas are received, by the memory which retains them, by the fantasy which can change them in various ways, and out of them compose new ideas, and which, by the same means, distributing the animal spirits through the muscles, can cause the members of such a body to move in as many different ways, and in a manner as suited, whether to the objects that are presented to its senses or to its internal affections, as can take place in our own case apart from the guidance of the will. Nor will this appear at all strange to those who are acquainted with the variety of movements performed by the different automata, or moving machines fabricated by human industry, and that with help of but few pieces compared with the great multitude of bones, muscles, nerves, arteries, veins, and other parts that are found in the body of each animal. Such persons will look upon this body as a machine made by the hands of God, which is incomparably better arranged, and adequate to movements more admirable than is any machine of human invention. And here I specially stayed to show that, were there such machines exactly resembling organs and outward form an ape or any other irrational animal, we could have no means of knowing that they were in any respect of a different nature from these animals; but if there were machines bearing the image of our bodies, and capable of imitating our actions as far as it is morally possible, there would still remain two most certain tests whereby to know that they were not therefore really men. Of these the first is that they could never use words or other signs arranged in such a manner as is competent to us in order to declare our thoughts to others: for we may easily conceive a machine to be so constructed that it emits vocables, and even that it emits some correspondent to the action upon it of external objects which cause a change in its organs; for example, if touched in a particular place it may demand what we wish to say to it; if in another it may cry out that it is hurt, and
such like; but not that it should arrange them variously so as appositely
to reply to what is said in its presence, as men of the lowest grade of
intellect can do. The second test is, that although such machines might
execute many things with equal or perhaps greater perfection than
any of us, they would, without doubt, fail in certain others from which
it could be discovered that they did not act from knowledge, but solely
from the disposition of their organs: for while reason is an universal
instrument that is alike available on every occasion, these organs, on
the contrary, need a particular arrangement for each particular action;
whence it must be morally impossible that there should exist in any
machine a diversity of organs sufficient to enable it to act in all the
occurrences of life, in the way in which our reason enables us to act.
Again, by means of these two tests we may likewise know the difference
between men and brutes. For it is highly deserving of remark, that
there are no men so dull and stupid, not even idiots, as to be incapable
of joining together different words, and thereby constructing a decla-
ration by which to make their thoughts understood; and that on the
other hand, there is no other animal, however perfect or happily cir-
cumstanced, which can do the like. Nor does this inability arise from
want of organs: for we observe that magpies and parrots can utter
words like ourselves, and are yet unable to speak as we do, that is, so
as to show that they understand what they say; in place of which men
born deaf and dumb, and thus not less, but rather more than the
brutes, destitute of the organs which others use in speaking, are in the
habit of spontaneously inventing certain signs by which they discover
their thoughts to those who, being usually in their company, have
leisure to learn their language. And this proves not only that the brutes
have less reason than man, but that they have none at all: for we see
that very little is required to enable a person to speak; and since a
certain inequality of capacity is observable among animals of the same
species, as well as among men, and since some are more capable of
being instructed than others, it is incredible that the most perfect ape
or parrot of its species, should not in this be equal to the most stupid
infant of its kind or at least to one that was crack-brained, unless the
soul of brutes were of a nature wholly different from ours. And we
ought not to confound speech with the natural movements which
René Descartes

indicate the passions, and can be imitated by machines as well as manifested by animals; nor must it be thought with certain of the ancients, that the brutes speak, although we do not understand their language. For if such were the case, since they are endowed with many organs analogous to ours, they could as easily communicate their thoughts to us as to their fellows. It is also very worthy of remark, that, though there are many animals which manifest more industry than we in certain of their actions, the same animals are yet observed to show none at all in many others: so that the circumstance that they do better than we does not prove that they are endowed with mind, for it would thence follow that they possessed greater reason than any of us, and could surpass us in all things; on the contrary, it rather proves that they are destitute of reason, and that it is nature which acts in them according to the disposition of their organs: thus it is seen, that a clock composed only of wheels and weights can number the hours and measure time more exactly than we with all our skin.

I had after this described the reasonable soul, and shown that it could by no means be educed from the power of matter, as the other things of which I had spoken, but that it must be expressly created; and that it is not sufficient that it be lodged in the human body exactly like a pilot in a ship, unless perhaps to move its members, but that it is necessary for it to be joined and united more closely to the body, in order to have sensations and appetites similar to ours, and thus constitute a real man. I here entered, in conclusion, upon the subject of the soul at considerable length, because it is of the greatest moment: for after the error of those who deny the existence of God, an error which I think I have already sufficiently refuted, there is none that is more powerful in leading feeble minds astray from the straight path of virtue than the supposition that the soul of the brutes is of the same nature with our own; and consequently that after this life we have nothing to hope for or fear, more than flies and ants; in place of which, when we know how far they differ we much better comprehend the reasons which establish that the soul is of a nature wholly independent of the body, and that consequently it is not liable to die with the latter and, finally, because no other causes are observed capable of destroying it, we are naturally led thence to judge that it is immortal.
PART VI

Three years have now elapsed since I finished the treatise containing all these matters; and I was beginning to revise it, with the view to put it into the hands of a printer, when I learned that persons to whom I greatly defer, and whose authority over my actions is hardly less influential than is my own reason over my thoughts, had condemned a certain doctrine in physics, published a short time previously by another individual to which I will not say that I adhered, but only that, previously to their censure I had observed in it nothing which I could imagine to be prejudicial either to religion or to the state, and nothing therefore which would have prevented me from giving expression to it in writing, if reason had persuaded me of its truth; and this led me to fear lest among my own doctrines likewise some one might be found in which I had departed from the truth, notwithstanding the great care I have always taken not to accord belief to new opinions of which I had not the most certain demonstrations, and not to give expression to aught that might tend to the hurt of any one. This has been sufficient to make me alter my purpose of publishing them; for although the reasons by which I had been induced to take this resolution were very strong, yet my inclination, which has always been hostile to writing books, enabled me immediately to discover other considerations sufficient to excuse me for not undertaking the task. And these reasons, on one side and the other, are such, that not only is it in some measure my interest here to state them, but that of the public, perhaps, to know them.

I have never made much account of what has proceeded from my own mind; and so long as I gathered no other advantage from
the method I employ beyond satisfying myself on some difficulties belonging to the speculative sciences, or endeavoring to regulate my actions according to the principles it taught me, I never thought myself bound to publish anything respecting it. For in what regards manners, every one is so full of his own wisdom, that there might be found as many reformers as heads, if any were allowed to take upon themselves the task of mending them, except those whom God has constituted the supreme rulers of his people or to whom he has given sufficient grace and zeal to be prophets; and although my speculations greatly pleased myself, I believed that others had theirs, which perhaps pleased them still more. But as soon as I had acquired some general notions respecting physics, and beginning to make trial of them in various particular difficulties, had observed how far they can carry us, and how much they differ from the principles that have been employed up to the present time, I believed that I could not keep them concealed without sinning grievously against the law by which we are bound to promote, as far as in us lies, the general good of mankind. For by them I perceived it to be possible to arrive at knowledge highly useful in life; and in room of the speculative philosophy usually taught in the schools, to discover a practical, by means of which, knowing the force and action of fire, water, air the stars, the heavens, and all the other bodies that surround us, as distinctly as we know the various crafts of our artisans, we might also apply them in the same way to all the uses to which they are adapted, and thus render ourselves the lords and possessors of nature. And this is a result to be desired, not only in order to the invention of an infinity of arts, by which we might be enabled to enjoy without any trouble the fruits of the earth, and all its comforts, but also and especially for the preservation of health, which is without doubt, of all the blessings of this life, the first and fundamental one; for the mind is so intimately dependent upon the condition and relation of the organs of the body, that if any means can ever be found to render men wiser and more ingenious than hitherto, I believe that it is in medicine they must be sought for. It is true that the science of medicine, as it now exists, contains few things whose utility is very remarkable: but without any wish to depreciate it, I am confident that there is no one, even among those whose profession
it is, who does not admit that all at present known in it is almost nothing in comparison of what remains to be discovered; and that we could free ourselves from an infinity of maladies of body as well as of mind, and perhaps also even from the debility of age, if we had sufficiently ample knowledge of their causes, and of all the remedies provided for us by nature. But since I designed to employ my whole life in the search after so necessary a science, and since I had fallen in with a path which seems to me such, that if any one follow it he must inevitably reach the end desired, unless he be hindered either by the shortness of life or the want of experiments, I judged that there could be no more effectual provision against these two impediments than if I were faithfully to communicate to the public all the little I might myself have found, and incite men of superior genius to strive to proceed farther, by contributing, each according to his inclination and ability, to the experiments which it would be necessary to make, and also by informing the public of all they might discover, so that, by the last beginning where those before them had left off, and thus connecting the lives and labours of many, we might collectively proceed much farther than each by himself could do.

I remarked, moreover, with respect to experiments, that they become always more necessary the more one is advanced in knowledge; for, at the commencement, it is better to make use only of what is spontaneously presented to our senses, and of which we cannot remain ignorant, provided we bestow on it any reflection, however slight, than to concern ourselves about more uncommon and recondite phenomena: the reason of which is, that the more uncommon often only mislead us so long as the causes of the more ordinary are still unknown; and the circumstances upon which they depend are almost always so special and minute as to be highly difficult to detect. But in this I have adopted the following order: first, I have essayed to find in general the principles, or first causes of all that is or can be in the world, without taking into consideration for this end anything but God himself who has created it, and without educing them from any other source than from certain germs of truths naturally existing in our minds In the second place, I examined what were the first and most ordinary effects that could be deduced from these causes; and it
appears to me that, in this way, I have found heavens, stars, an earth, and even on the earth water, air, fire, minerals, and some other things of this kind, which of all others are the most common and simple, and hence the easiest to know. Afterwards when I wished to descend to the more particular, so many diverse objects presented themselves to me, that I believed it to be impossible for the human mind to distinguish the forms or species of bodies that are upon the earth, from an infinity of others which might have been, if it had pleased God to place them there, or consequently to apply them to our use, unless we rise to causes through their effects, and avail ourselves of many particular experiments. Thereupon, turning over in my mind I the objects that had ever been presented to my senses I freely venture to state that I have never observed any which I could not satisfactorily explain by the principles had discovered. But it is necessary also to confess that the power of nature is so ample and vast, and these principles so simple and general, that I have hardly observed a single particular effect which I cannot at once recognize as capable of being deduced in man different modes from the principles, and that my greatest difficulty usually is to discover in which of these modes the effect is dependent upon them; for out of this difficulty cannot otherwise extricate myself than by again seeking certain experiments, which may be such that their result is not the same, if it is in the one of these modes at we must explain it, as it would be if it were to be explained in the other. As to what remains, I am now in a position to discern, as I think, with sufficient clearness what course must be taken to make the majority those experiments which may conduce to this end: but I perceive likewise that they are such and so numerous, that neither my hands nor my income, though it were a thousand times larger than it is, would be sufficient for them all; so that according as henceforward I shall have the means of making more or fewer experiments, I shall in the same proportion make greater or less progress in the knowledge of nature. This was what I had hoped to make known by the treatise I had written, and so clearly to exhibit the advantage that would thence accrue to the public, as to induce all who have the common good of man at heart, that is, all who are virtuous in truth, and not merely in appearance, or according to opinion, as well to communicate to me
the experiments they had already made, as to assist me in those that remain to be made.

But since that time other reasons have occurred to me, by which I have been led to change my opinion, and to think that I ought indeed to go on committing to writing all the results which I deemed of any moment, as soon as I should have tested their truth, and to bestow the same care upon them as I would have done had it been my design to publish them. This course commended itself to me, as well because I thus afforded myself more ample inducement to examine them thoroughly, for doubtless that is always more narrowly scrutinized which we believe will be read by many, than that which is written merely for our private use (and frequently what has seemed to me true when I first conceived it, has appeared false when I have set about committing it to writing), as because I thus lost no opportunity of advancing the interests of the public, as far as in me lay, and since thus likewise, if my writings possess any value, those into whose hands they may fall after my death may be able to put them to what use they deem proper. But I resolved by no means to consent to their publication during my lifetime, lest either the oppositions or the controversies to which they might give rise, or even the reputation, such as it might be, which they would acquire for me, should be any occasion of my losing the time that I had set apart for my own improvement. For though it be true that every one is bound to promote to the extent of his ability the good of others, and that to be useful to no one is really to be worthless, yet it is likewise true that our cares ought to extend beyond the present, and it is good to omit doing what might perhaps bring some profit to the living, when we have in view the accomplishment of other ends that will be of much greater advantage to posterity. And in truth, I am quite willing it should be known that the little I have hitherto learned is almost nothing in comparison with that of which I am ignorant, and to the knowledge of which I do not despair of being able to attain; for it is much the same with those who gradually discover truth in the sciences, as with those who when growing rich find less difficulty in making great acquisitions, than they formerly experienced when poor in making acquisitions of much smaller amount. Or they may be compared to the commanders of armies, whose forces
usually increase in proportion to their victories, and who need greater prudence to keep together the residue of their troops after a defeat than after a victory to take towns and provinces. For he truly engages in battle who endeavors to surmount all the difficulties and errors which prevent him from reaching the knowledge of truth, and he is overcome in fight who admits a false opinion touching a matter of any generality and importance, and he requires thereafter much more skill to recover his former position than to make great advances when once in possession of thoroughly ascertained principles. As for myself, if I have succeeded in discovering any truths in the sciences (and I trust that what is contained in this volume I will show that I have found some), I can declare that they are but the consequences and results of five or six principal difficulties which I have surmounted, and my encounters with which I reckoned as battles in which victory declared for me. I will not hesitate even to avow my belief that nothing further is wanting to enable me fully to realize my designs than to gain two or three similar victories; and that I am not so far advanced in years but that, according to the ordinary course of nature, I may still have sufficient leisure for this end. But I conceive myself the more bound to husband the time that remains the greater my expectation of being able to employ it aright, and I should doubtless have much to rob me of it, were I to publish the principles of my physics: for although they are almost all so evident that to assent to them no more is needed than simply to understand them, and although there is not one of them of which I do not expect to be able to give demonstration, yet, as it is impossible that they can be in accordance with all the diverse opinions of others, I foresee that I should frequently be turned aside from my grand design, on occasion of the opposition which they would be sure to awaken.

It may be said, that these oppositions would be useful both in making me aware of my errors, and, if my speculations contain anything of value, in bringing others to a fuller understanding of it; and still farther, as many can see better than one, in leading others who are now beginning to avail themselves of my principles, to assist me in turn with their discoveries. But though I recognize my extreme liability to error, and scarce ever trust to the first thoughts which
occur to me, yet-the experience I have had of possible objections to
my views prevents me from anticipating any profit from them. For I
have already had frequent proof of the judgments, as well of those
I esteemed friends, as of some others to whom I thought I was an
object of indifference, and even of some whose malignancy and envy
would, I knew, determine them to endeavor to discover what partiality
concealed from the eyes of my friends. But it has rarely happened
that anything has been objected to me which I had myself altogether
overlooked, unless it were something far removed from the subject:
so that I have never met with a single critic of my opinions who did
not appear to me either less rigorous or less equitable than myself.
And further, I have never observed that any truth before unknown
has been brought to light by the disputations that are practised in the
schools; for while each strives for the victory, each is much more occu-
pied in making the best of mere verisimilitude, than in weighing the
reasons on both sides of the question; and those who have been long
good advocates are not afterwards on that account the better judges.

As for the advantage that others would derive from the communi-
cation of my thoughts, it could not be very great; because I have not
yet so far prosecuted them as that much does not remain to be added
before they can be applied to practice. And I think I may say without
vanity, that if there is any one who can carry them out that length, it
must be myself rather than another: not that there may not be in the
world many minds incomparably superior to mine, but because one
cannot so well seize a thing and make it one’s own, when it has been
learned from another, as when one has himself discovered it. And so
ture is this of the present subject that, though I have often explained
some of my opinions to persons of much acuteness, who, whilst I was
speaking, appeared to understand them very distinctly, yet, when they
repeated them, I have observed that they almost always changed them
to such an extent that I could no longer acknowledge them as mine.
I am glad, by the way, to take this opportunity of requesting posterity
never to believe on hearsay that anything has proceeded from me
which has not been published by myself; and I am not at all astonished
at the extravagances attributed to those ancient philosophers whose
own writings we do not possess; whose thoughts, however, I do not
on that account suppose to have been really absurd, seeing they were among the ablest men of their times, but only that these have been falsely represented to us. It is observable, accordingly, that scarcely in a single instance has any one of their disciples surpassed them; and I am quite sure that the most devoted of the present followers of Aristotle would think themselves happy if they had as much knowledge of nature as he possessed, were it even under the condition that they should never afterwards attain to higher. In this respect they are like the ivy which never strives to rise above the tree that sustains it, and which frequently even returns downwards when it has reached the top; for it seems to me that they also sink, in other words, render themselves less wise than they would be if they gave up study, who, not contented with knowing all that is intelligibly explained in their author, desire in addition to find in him the solution of many difficulties of which he says not a word, and never perhaps so much as thought. Their fashion of philosophizing, however, is well suited to persons whose abilities fall below mediocrity; for the obscurity of the distinctions and principles of which they make use enables them to speak of all things with as much confidence as if they really knew them, and to defend all that they say on any subject against the most subtle and skillful, without its being possible for any one to convict them of error. In this they seem to me to be like a blind man, who, in order to fight on equal terms with a person that sees, should have made him descend to the bottom of an intensely dark cave: and I may say that such persons have an interest in my refraining from publishing the principles of the philosophy of which I make use; for, since these are of a kind the simplest and most evident, I should, by publishing them, do much the same as if I were to throw open the windows, and allow the light of day to enter the cave into which the combatants had descended. But even superior men have no reason for any great anxiety to know these principles, for if what they desire is to be able to speak of all things, and to acquire a reputation for learning, they will gain their end more easily by remaining satisfied with the appearance of truth, which can be found without much difficulty in all sorts of matters, than by seeking the truth itself which unfolds itself but slowly and that only in some departments, while
it obliges us, when we have to speak of others, freely to confess our ignorance. If, however, they prefer the knowledge of some few truths to the vanity of appearing ignorant of none, as such knowledge is undoubtedly much to be preferred, and, if they choose to follow a course similar to mine, they do not require for this that I should say anything more than I have already said in this discourse. For if they are capable of making greater advancement than I have made, they will much more be able of themselves to discover all that I believe myself to have found; since as I have never examined aught except in order, it is certain that what yet remains to be discovered is in itself more difficult and recondite, than that which I have already been enabled to find, and the gratification would be much less in learning it from me than in discovering it for themselves. Besides this, the habit which they will acquire, by seeking first what is easy, and then passing onward slowly and step by step to the more difficult, will benefit them more than all my instructions. Thus, in my own case, I am persuaded that if I had been taught from my youth all the truths of which I have since sought out demonstrations, and had thus learned them without labour, I should never, perhaps, have known any beyond these; at least, I should never have acquired the habit and the facility which I think I possess in always discovering new truths in proportion as I give myself to the search. And, in a single word, if there is any work in the world which cannot be so well finished by another as by him who has commenced it, it is that at which I labour.

It is true, indeed, as regards the experiments which may conduce to this end, that one man is not equal to the task of making them all; but yet he can advantageously avail himself, in this work, of no hands besides his own, unless those of artisans, or parties of the same kind, whom he could pay, and whom the hope of gain (a means of great efficacy) might stimulate to accuracy in the performance of what was prescribed to them. For as to those who, through curiosity or a desire of learning, of their own accord, perhaps, offer him their services, besides that in general their promises exceed their performance, and that they sketch out fine designs of which not one is ever realized, they will, without doubt, expect to be compensated for their trouble by the explication of some difficulties, or, at least, by compliments and useless
speeches, in which he cannot spend any portion of his time without loss to himself. And as for the experiments that others have already made, even although these parties should be willing of themselves to communicate them to him (which is what those who esteem them secrets will never do), the experiments are, for the most part, accompanied with so many circumstances and superfluous elements, as to make it exceedingly difficult to disentangle the truth from its adjuncts—besides, he will find almost all of them so ill described, or even so false (because those who made them have wished to see in them only such facts as they deemed conformable to their principles), that, if in the entire number there should be some of a nature suited to his purpose, still their value could not compensate for the time what would be necessary to make the selection. So that if there existed any one whom we assuredly knew to be capable of making discoveries of the highest kind, and of the greatest possible utility to the public; and if all other men were therefore eager by all means to assist him in successfully prosecuting his designs, I do not see that they could do aught else for him beyond contributing to defray the expenses of the experiments that might be necessary; and for the rest, prevent his being deprived of his leisure by the unseasonable interruptions of any one. But besides that I neither have so high an opinion of myself as to be willing to make promise of anything extraordinary, nor feed on imaginations so vain as to fancy that the public must be much interested in my designs; I do not, on the other hand, own a soul so mean as to be capable of accepting from any one a favor of which it could be supposed that I was unworthy.

These considerations taken together were the reason why, for the last three years, I have been unwilling to publish the treatise I had on hand, and why I even resolved to give publicity during my life to no other that was so general, or by which the principles of my physics might be understood. But since then, two other reasons have come into operation that have determined me here to subjoin some particular specimens, and give the public some account of my doings and designs. Of these considerations, the first is, that if I failed to do so, many who were cognizant of my previous intention to publish some writings, might have imagined that the reasons which induced me to refrain from so doing, were less to my credit than they really are; for
although I am not immoderately desirous of glory, or even, if I may venture so to say, although I am averse from it in so far as I deem it hostile to repose which I hold in greater account than aught else, yet, at the same time, I have never sought to conceal my actions as if they were crimes, nor made use of many precautions that I might remain unknown; and this partly because I should have thought such a course of conduct a wrong against myself, and partly because it would have occasioned me some sort of uneasiness which would again have been contrary to the perfect mental tranquillity which I court. And forasmuch as, while thus indifferent to the thought alike of fame or of forgetfulness, I have yet been unable to prevent myself from acquiring some sort of reputation, I have thought it incumbent on me to do my best to save myself at least from being ill-spoken of. The other reason that has determined me to commit to writing these specimens of philosophy is, that I am becoming daily more and more alive to the delay which my design of self-instruction suffers, for want of the infinity of experiments I require, and which it is impossible for me to make without the assistance of others: and, without flattering myself so much as to expect the public to take a large share in my interests, I am yet unwilling to be found so far wanting in the duty I owe to myself, as to give occasion to those who shall survive me to make it matter of reproach against me some day, that I might have left them many things in a much more perfect state than I have done, had I not too much neglected to make them aware of the ways in which they could have promoted the accomplishment of my designs.

And I thought that it was easy for me to select some matters which should neither be obnoxious to much controversy, nor should compel me to expound more of my principles than I desired, and which should yet be sufficient clearly to exhibit what I can or cannot accomplish in the sciences. Whether or not I have succeeded in this it is not for me to say; and I do not wish to forestall the judgments of others by speaking myself of my writings; but it will gratify me if they be examined, and, to afford the greater inducement to this I request all who may have any objections to make to them, to take the trouble of forwarding these to my publisher, who will give me notice of them, that I may endeavor to subjoin at the same time my reply; and in this
way readers seeing both at once will more easily determine where
the truth lies; for I do not engage in any case to make prolix replies,
but only with perfect frankness to avow my errors if I am convinced
of them, or if I cannot perceive them, simply to state what I think is
required for defense of the matters I have written, adding thereto
no explication of any new matter that it may not be necessary to pass
without end from one thing to another.

If some of the matters of which I have spoken in the beginning of
the “Dioptrics” and “Meteorics” should offend at first sight, because I
call them hypotheses and seem indifferent about giving proof of them,
I request a patient and attentive reading of the whole, from which I
hope those hesitating will derive satisfaction; for it appears to me that
the reasonings are so mutually connected in these treatises, that, as the
last are demonstrated by the first which are their causes, the first are in
their turn demonstrated by the last which are their effects. Nor must it
be imagined that I here commit the fallacy which the logicians call a
circle; for since experience renders the majority of these effects most
certain, the causes from which I deduce them do not serve so much to
establish their reality as to explain their existence; but on the contrary,
the reality of the causes is established by the reality of the effects. Nor
have I called them hypotheses with any other end in view except that
it may be known that I think I am able to deduce them from those first
truths which I have already expounded; and yet that I have expressly
determined not to do so, to prevent a certain class of minds from
thence taking occasion to build some extravagant philosophy upon
what they may take to be my principles, and my being blamed for it.
I refer to those who imagine that they can master in a day all that
another has taken twenty years to think out, as soon as he has spoken
two or three words to them on the subject; or who are the more liable
to error and the less capable of perceiving truth in very proportion
as they are more subtle and lively. As to the opinions which are truly
and wholly mine, I offer no apology for them as new,—persuaded as I
am that if their reasons be well considered they will be found to be so
simple and so conformed, to common sense as to appear less extraor-
dinary and less paradoxical than any others which can be held on the
same subjects; nor do I even boast of being the earliest discoverer of

any of them, but only of having adopted them, neither because they had nor because they had not been held by others, but solely because reason has convinced me of their truth.

Though artisans may not be able at once to execute the invention which is explained in the “Dioptrics,” I do not think that any one on that account is entitled to condemn it; for since address and practice are required in order so to make and adjust the machines described by me as not to overlook the smallest particular, I should not be less astonished if they succeeded on the first attempt than if a person were in one day to become an accomplished performer on the guitar, by merely having excellent sheets of music set up before him. And if I write in French, which is the language of my country, in preference to Latin, which is that of my preceptors, it is because I expect that those who make use of their unprejudiced natural reason will be better judges of my opinions than those who give heed to the writings of the ancients only; and as for those who unite good sense with habits of study, whom alone I desire for judges, they will not, I feel assured, be so partial to Latin as to refuse to listen to my reasonings merely because I expound them in the vulgar tongue.

In conclusion, I am unwilling here to say anything very specific of the progress which I expect to make for the future in the sciences, or to bind myself to the public by any promise which I am not certain of being able to fulfill; but this only will I say, that I have resolved to devote what time I may still have to live to no other occupation than that of endeavoring to acquire some knowledge of Nature, which shall be of such a kind as to enable us therefrom to deduce rules in medicine of greater certainty than those at present in use; and that my inclination is so much opposed to all other pursuits, especially to such as cannot be useful to some without being hurtful to others, that if, by any circumstances, I had been constrained to engage in such, I do not believe that I should have been able to succeed. Of this I here make a public declaration, though well aware that it cannot serve to procure for me any consideration in the world, which, however, I do not in the least affect; and I shall always hold myself more obliged to those through whose favor I am permitted to enjoy my retirement without interruption than to any who might offer me the highest earthly preferments.
MEDITATIONS

ON THE FIRST PHILOSOPHY

IN WHICH THE EXISTENCE OF GOD

AND THE DISTINCTION BETWEEN MIND

AND BODY ARE DEMONSTRATED.

René Descartes

Translator: Elizabeth S Haldane
MEDITATION I.

Of the things which may be brought within the sphere of the doubtful.

It is now some years since I detected how many were the false beliefs that I had from my earliest youth admitted as true, and how doubtful was everything I had since constructed on this basis; and from that time I was convinced that I must once for all seriously undertake to rid myself of all the opinions which I had formerly accepted, and commence to build anew from the foundation, if I wanted to establish any firm and permanent structure in the sciences. But as this enterprise appeared to be a very great one, I waited until I had attained an age so mature that I could not hope that at any later date I should be better fitted to execute my design. This reason caused me to delay so long that I should feel that I was doing wrong were I to occupy in deliberation the time that yet remains to me for action. To-day, then, since very opportunely for the plan I have in view I have delivered my mind from every care [and am happily agitated by no passions] and since I have procured for myself an assured leisure in a peaceable retirement, I shall at last seriously and freely address myself to the general upheaval of all my former opinions.

Now for this object it is not necessary that I should show that all of these are false I shall perhaps never arrive at this end. But inasmuch as reason already persuades me that I ought no less carefully to withhold my assent from matters which are not entirely certain and indubitable than from those which appear to me manifestly to be false, if I am able to find in each one some reason to doubt, this will
suffice to justify my rejecting the whole. And for that end it will not be requisite that I should examine each in particular, which would be an endless undertaking; for owing to the fact that the destruction of the foundations of necessity brings with it the downfall of the rest of the edifice, I shall only in the first place attack those principles upon which all my former opinions rested.

All that up to the present time I have accepted as most true and certain I have learned either from the senses or through the senses; but it is sometimes proved to me that these senses are deceptive, and it is wiser not to trust entirely to anything by which we have once been deceived.

But it may be that although the senses sometimes deceive us concerning things which are hardly perceptible, or very far away, there are yet many others to be met with as to which we cannot reasonably have any doubt, although we recognise them by their means. For example, there is the fact that I am here, seated by the fire, attired in a dressing gown, having this paper in my hands and other similar matters. And how could I deny that these hands and this body are mine, were it not perhaps that I compare myself to certain persons, devoid of sense, whose cerebella are so troubled and clouded by the violent vapours of black bile, that they constantly assure us that they think they are kings when they are really quite poor, or that they are clothed in purple when they are really without covering, or who imagine that they have an earthenware head or are nothing but pumpkins or are made of glass. But they are mad, and I should not be any the less insane were I to follow examples so extravagant.

At the same time I must remember that I am a man, and that consequently I am in the habit of sleeping, and in my dreams representing to myself the same things or sometimes even less probable things, than do those who are insane in their waking moments. How often has it happened to me that in the night I dreamt that I found myself in this particular place, that I was dressed and seated near the fire, whilst in reality I was lying undressed in bed! At this moment it does indeed seem to me that it is with eyes awake that I am looking at this paper; that this head which I move is not asleep, that it is deliberately and of set purpose that I extend my hand and perceive it; what happens in sleep does not appear so clear nor so distinct as does all this. But in
thinking over this I remind myself that on many occasions I have in sleep been deceived by similar illusions, and in dwelling carefully on this reflection I see so manifestly that there are no certain indications by which we may clearly distinguish wakefulness from sleep that I am lost in astonishment. And my astonishment is such that it is almost capable of persuading me that I now dream.

Now let us assume that we are asleep and that all these particulars, e.g. that we open our eyes, shake our head, extend our hands, and so on, are but false delusions; and let us reflect that possibly neither our hands nor our whole body are such as they appear to us to be. At the same time we must at least confess that the things which are represented to us in sleep are like painted representations which can only have been formed as the counterparts of something real and true, and that in this way those general things at least, i.e. eyes, a head, hands, and a whole body, are not imaginary things, but things really existent. For, as a matter of fact, painters, even when they study with the greatest skill to represent sirens and satyrs by forms the most strange and extraordinary, cannot give them natures which are entirely new, but merely make a certain medley of the members of different animals; or if their imagination is extravagant enough to invent something so novel that nothing similar has ever before been seen, and that then their work represents a thing purely fictitious and absolutely false, it is certain all the same that the colours of which this is composed are necessarily real. And for the same reason, although these general things, to wit, [a body], eyes, a head, hands, and such like, may be imaginary, we are bound at the same time to confess that there are at least some other objects yet more simple and more universal, which are real and true; and of these just in the same way as with certain real colours, all these images of things which dwell in our thoughts, whether true and real or false and fantastic, are formed.

To such a class of things pertains corporeal nature in general, and its extension, the figure of extended things, their quantity or magnitude and number, as also the place in which they are, the time which measures their duration, and so on.

That is possibly why our reasoning is not unjust when we conclude from this that Physics, Astronomy, Medicine and all other sciences
which have as their end the consideration of composite things, are very dubious and uncertain; but that Arithmetic, Geometry and other sciences of that kind which only treat of things that are very simple and very general, without taking great trouble to ascertain whether they are actually existent or not, contain some measure of certainty and an element of the indubitable. For whether I am awake or asleep, two and three together always form five, and the square can never have more than four sides, and it does not seem possible that truths so clear and apparent can be suspected of any falsity [or uncertainty].

Nevertheless I have long had fixed in my mind the belief that an all-powerful God existed by whom I have been created such as I am. But how do I know that He has not brought it to pass that there is no earth, no heaven, no extended body, no magnitude, no place, and that nevertheless [I possess the perceptions of all these things and that] they seem to me to exist just exactly as I now see them? And, besides, as I sometimes imagine that others deceive themselves in the things which they think they know best, how do I know that I am not deceived every time that I add two and three, or count the sides of a square, or judge of things yet simpler, if anything simpler can be imagined? But possibly God has not desired that I should be thus deceived, for He is said to be supremely good. If, however, it is contrary to His goodness to have made me such that I constantly deceive myself, it would also appear to be contrary to His goodness to permit me to be sometimes deceived, and nevertheless I cannot doubt that He does permit this.

There may indeed be those who would prefer to deny the existence of a God so powerful, rather than believe that all other things are uncertain. But let us not oppose them for the present, and grant that all that is here said of a God is a fable; nevertheless in whatever way they suppose that I have arrived at the state of being that I have reached whether they attribute it to fate or to accident, or make out that it is by a continual succession of antecedents, or by some other method since to err and deceive oneself is a defect, it is clear that the greater will be the probability of my being so imperfect as to deceive myself ever, as is the Author to whom they assign my origin the less powerful. To these reasons I have certainly nothing to reply, but at
the end I feel constrained to confess that there is nothing in all that I formerly believed to be true, of which I cannot in some measure doubt, and that not merely through want of thought or through levity, but for reasons which are very powerful and maturely considered; so that henceforth I ought not the less carefully to refrain from giving credence to these opinions than to that which is manifestly false, if I desire to arrive at any certainty [in the sciences].

But it is not sufficient to have made these remarks, we must also be careful to keep them in mind. For these ancient and commonly held opinions still revert frequently to my mind, long and familiar custom having given them the right to occupy my mind against my inclination and rendered them almost masters of my belief; nor will I ever lose the habit of deferring to them or of placing my confidence in them, so long as I consider them as they really are, i.e. opinions in some measure doubtful, as I have just shown, and at the same time highly probable, so that there is much more reason to believe in than to deny them. That is why I consider that I shall not be acting amiss, if, taking of set purpose a contrary belief, I allow myself to be deceived, and for a certain time pretend that all these opinions are entirely false and imaginary, until at last, having thus balanced my former prejudices with my latter [so that they cannot divert my opinions more to one side than to the other], my judgment will no longer be dominated by bad usage or turned away from the right knowledge of the truth. For I am assured that there can be neither peril nor error in this course, and that I cannot at present yield too much to distrust, since I am not considering the question of action, but only of knowledge.

I shall then suppose, not that God who is supremely good and the fountain of truth, but some evil genius not less powerful than deceitful, has employed his whole energies in deceiving me; I shall consider that the heavens, the earth, colours, figures, sound, and all other external things are nought but the illusions and dreams of which this genius has availed himself in order to lay traps for my credulity; I shall consider myself as having no hands, no eyes, no flesh, no blood, nor any senses, yet falsely believing myself to possess all these things; I shall remain obstinately attached to this idea, and if by this means it is not in my power to arrive at the knowledge of any truth, I
may at least do what is in my power [i.e. suspend my judgment], and with firm purpose avoid giving credence to any false thing, or being imposed upon by this arch deceiver, however powerful and deceptive he may be. But this task is a laborious one, and insensibly a certain lassitude leads me into the course of my ordinary life. And just as a captive who in sleep enjoys an imaginary liberty, when he begins to suspect that his liberty is but a dream, fears to awaken, and conspires with these agreeable illusions that the deception may be prolonged, so insensibly of my own accord I fall back into my former opinions, and I dread awakening from this slumber, lest the laborious wakefulness which would follow the tranquillity of this repose should have to be spent not in daylight, but in the excessive darkness of the difficulties which have just been discussed.
MEDITATION II

Of the Nature of the Human Mind;
and that it is more easily known than the Body.

The Meditation of yesterday filled my mind with so many doubts that it is no longer in my power to forget them. And yet I do not see in what manner I can resolve them; and, just as if I had all of a sudden fallen into very deep water, I am so disconcerted that I can neither make certain of setting my feet on the bottom, nor can I swim and so support myself on the surface. I shall nevertheless make an effort and follow anew the same path as that on which I yesterday entered, i.e. I shall proceed by setting aside all that in which the least doubt could be supposed to exist, just as if I had discovered that it was absolutely false; and I shall ever follow in this road until I have met with something which is certain, or at least, if I can do nothing else, until I have learned for certain that there is nothing in the world that is certain. Archimedes, in order that he might draw the terrestrial globe out of its place, and transport it elsewhere, demanded only that one point should be fixed and immoveable; in the same way I shall have the right to conceive high hopes if I am happy enough to discover one thing only which is certain and indubitable.

I suppose, then, that all the things that I see are false; I persuade myself that nothing has ever existed of all that my fallacious memory represents to me. I consider that I possess no senses; I imagine that body, figure, extension, movement and place are but the fictions of
my mind. What, then, can be esteemed as true? Perhaps nothing at all, unless that there is nothing in the world that is certain.

But how can I know there is not something different from those things that I have just considered, of which one cannot have the slightest doubt? Is there not some God, or some other being by whatever name we call it, who puts these reflections into my mind? That is not necessary, for is it not possible that I am capable of producing them myself? I myself, am I not at least something? But I have already denied that I had senses and body. Yet I hesitate, for what follows from that? Am I so dependent on body and senses that I cannot exist without these? But I was persuaded that there was nothing in all the world, that there was no heaven, no earth, that there were no minds, nor any bodies: was I not then likewise persuaded that I did not exist? Not at all; of a surety I myself did exist since I persuaded myself of something [or merely because I thought of something]. But there is some deceiver or other, very powerful and very cunning, who ever employs his ingenuity in deceiving me. Then without doubt I exist also if he deceives me, and let him deceive me as much as he will, he can never cause me to be nothing so long as I think that I am something. So that after having reflected well and carefully examined all things, we must come to the definite conclusion that this proposition: I am, I exist, is necessarily true each time that I pronounce it, or that I mentally conceive it.

But I do not yet know clearly enough what I am, I who am certain that I am; and hence I must be careful to see that I do not imprudently take some other object in place of myself, and thus that I do not go astray in respect of this knowledge that I hold to be the most certain and most evident of all that I have formerly learned. That is why I shall now consider anew what I believed myself to be before I embarked upon these last reflections; and of my former opinions I shall withdraw all that might even in a small degree be invalidated by the reasons which I have just brought forward, in order that there may be nothing at all left beyond what is absolutely certain and indubitable.

What then did I formerly believe myself to be? Undoubtedly I believed myself to be a man. But what is a man? Shall I say a reasonable
animal? Certainly not; for then I should have to inquire what an animal is, and what is reasonable; and thus from a single question I should insensibly fall into an infinitude of others more difficult; and I should not wish to waste the little time and leisure remaining to me in trying to unravel subtleties like these. But I shall rather stop here to consider the thoughts which of themselves spring up in my mind, and which were not inspired by anything beyond my own nature alone when I applied myself to the consideration of my being. In the first place, the, I considered myself as having a face, hands, arms, and all that system of members composed on bones and flesh as seen in a corpse which I designated by the name of body. In addition to this I considered that I was nourished, that I walked, that I felt, and that I thought, and I referred all these actions to the soul: but I did not stop to consider what the soul was, or if I did stop, I imagined that it was something extremely rare and subtle like a wind, a flame, or an ether, which was spread throughout my grosser parts. As to body I had no manner of doubt about its nature, but thought I had a very clear knowledge of it; and if I had desired to explain it according to the notions that I had then formed of it, I should have described it thus: By the body I understand all that which can be defined by a certain figure: something which can be confined in a certain place, and which can fill a given space in such a way that every other body will be excluded from it; which can be perceived either by tough, or by sight, or by hearing, or by taste, or by smell: which can be moved in many ways not, in truth, by itself, but by something which is foreign to it, by which it is touched [and from which it receives impressions]: for to have the power of self-movement, as also of feeling or of thinking, I did not consider to appertain to the nature of body: on the contrary, I was rather astonished to find that faculties similar to them existed in some bodies.

But what am I, now that I suppose that there is a certain genius which is extremely powerful, and, if I may say so, malicious, who employs all his powers in deceiving me? Can I affirm that I possess the least of all those things which I have just said pertain to the nature of body? I pause to consider, I revolve all these things in my mind, and I find none of which I can say that it pertains to me. It would be tedious to stop to enumerate them. Let us pass to the attributes of soul and see
if there is any one which is in me? What of nutrition or walking [the first mentioned]? But if it is so that I have no body it is also true that I can neither walk nor take nourishment. Another attribute is sensation. But one cannot feel without body, and besides I have thought I perceived many things during sleep that I recognised in my waking moments as not having been experienced at all. What of thinking? I find here that thought is an attribute that belongs to me; it alone cannot be separated from me. I am, I exist, that is certain. But how often? Just when I think; for it might possibly be the case if I ceased entirely to think, that I should likewise cease altogether to exist. I do not now admit anything which is not necessarily true: to speak accurately I am not more than a thing which thinks, that is to say a mind or a soul, or an understanding, or a reason, which are terms whose significance was formerly unknown to me. I am, however, a real thing and really exist; but what thing? I have answered: a thing which thinks.

And what more? I shall exercise my imagination [in order to see if I am not something more]. I am not a collection of members which we call the human body: I am not a subtle air distributed through these members, I am not a wind, a fire, a vapour, a breath, nor anything at all which I can imagine or conceive; because I have assumed that all these were nothing. Without changing that supposition I find that I only leave myself certain of the fact that I am somewhat. But perhaps it is true that these same things which I supposed were non-existent because they are unknown to me, are really not different from the self which I know. I am not sure about this, I shall not dispute about it now; I can only give judgment on things that are known to me. I know that I exist, and I inquire what I am, I whom I know to exist. But it is very certain that the knowledge of my existence taken in its precise significance does not depend on things whose existence is not yet known to me; consequently it does not depend on those which I can feign in imagination. And indeed the very term feign in imagination proves to me my error, for I really do this if I image myself a something, since to imagine is nothing else than to contemplate the figure or image of a corporeal thing. But I already know for certain that I am, and that it may be that all these images, and, speaking generally, all things that relate to the nature of body are nothing but
dreams [and chimeras]. For this reason I see clearly that I have as little reason to say, “I shall stimulate my imagination in order to know more distinctly what I am,” than if I were to say, “I am now awake, and I perceive somewhat that is real and true: but because I do not yet perceive it distinctly enough, I shall go to sleep of express purpose, so that my dreams may represent the perception with greatest truth and evidence.” And, thus, I know for certain that nothing of all that I can understand by means of my imagination belongs to this knowledge which I have of myself, and that it is necessary to recall the mind from this mode of thought with the utmost diligence in order that it may be able to know its own nature with perfect distinctness.

But what then am I? A thing which thinks. What is a thing which thinks? It is a thing which doubts, understands, [conceives], affirms, denies, wills, refuses, which also imagines and feels.

Certainly it is no small matter if all these things pertain to my nature. But why should they not so pertain? Am I not that being who now doubts nearly everything, who nevertheless understands certain things, who affirms that one only is true, who denies all the others, who desires to know more, is averse from being deceived, who imagines many things, sometimes indeed despite his will, and who perceives many likewise, as by the intervention of the bodily organs? Is there nothing in all this which is as true as it is certain that I exist, even though I should always sleep and though he who has given me being employed all his ingenuity in deceiving me? Is there likewise any one of these attributes which can be distinguished from my thought, or which might be said to be separated from myself? For it is so evident of itself that it is I who doubts, who understands, and who desires, that there is no reason here to add anything to explain it. And I have certainly the power of imagining likewise; for although it may happen (as I formerly supposed) that none of the things which I imagine are true, nevertheless this power of imagining does not cease to be really in use, and it forms part of my thought. Finally, I am the same who feels, that is to say, who perceives certain things, as by the organs of sense, since it truth I see light, I hear noise, I feel heat. But it will be said that these phenomena are false and that I am dreaming. Let it be so; still it is at least quite certain that it seems to me that I see light,
that I hear noise and that I feel heat. That cannot be false; properly speaking it is what is in me called feeling;11 and used in this precise sense that is no other thing than thinking.

From this time I begin to know what I am with a little more clearness and distinction than before; but nevertheless it still seems to me, and I cannot prevent myself from thinking, that corporeal things, whose images are framed by thought, which are tested by the senses, are much more distinctly known than that obscure part of me which does not come under the imagination. Although really it is very strange to say that I know and understand more distinctly these things whose existence seems to me dubious, which are unknown to me, and which do not belong to me, than others of the truth of which I am convinced, which are known to me and which pertain to my real nature, in a word, than myself. But I see clearly how the case stands: my mind loves to wander; and cannot yet suffer itself to be retained within the just limits of truth. Very good, let us once more give it the freest rein, so that, when afterwards we seize the proper occasion for pulling up, it may the more easily be regulated and controlled.

Let us begin by considering the commonest matters, those which we believe to be the most distinctly comprehended, to wit, the bodies which we touch and see; not indeed bodies in general, for these general ideas are usually a little more confused, but let us consider one body in particular. Let us take, for example, this piece of wax: it has been taken quite freshly from the hive, and it has not yet lost the sweetness of the honey which it contains; it still retains somewhat of the odour of the flowers from which it has been culled; its colour, its figure, its size are apparent; it is hard, cold, easily handled, and if you strike it with the finger, it will emit a sound. Finally all the things which are requisite to cause us distinctly to recognise a body, are met with in it. But notice that while I speak and approach the fire what remained of the taste is exhaled, the smell evaporates, the colour alters, the figure is destroyed, the size increases, it becomes liquid, it heats, scarcely can one handle it, and when one strikes it, now sound is emitted. Does the same wax remain after this change? We must confess that it remains; none would judge otherwise. What then did I know so distinctly in this piece of wax? It could certainly be nothing
of all that the senses brought to my notice, since all these things which fall under taste, smell, sight, touch, and hearing, are found to be changed, and yet the same wax remains.

Perhaps it was what I now think, viz. that this wax was not that sweetness of honey, nor that agreeable scent of flowers, nor that particular whiteness, nor that figure, nor that sound, but simply a body which a little while before appeared to me as perceptible under these forms, and which is now perceptible under others. But what, precisely, is it that I imagine when I form such conceptions? Let us attentively consider this, and, abstracting from all that does not belong to the wax, let us see what remains. Certainly nothing remains excepting a certain extended thing which is flexible and movable. But what is the meaning of flexible and movable? Is it not that I imagine that this piece of wax being round is capable of becoming square and of passing from a square to a triangular figure? No, certainly it is not that, since I imagine it admits of an infinitude of similar changes, and I nevertheless do not know how to compass the infinitude by my imagination, and consequently this conception which I have of the wax is not brought about by the faculty of imagination. What now is this extension? Is it not also unknown? For it becomes greater when the wax is melted, greater when it is boiled, and greater still when the heat increases; and I should not conceive [clearly] according to truth what wax is, if I did not think that even this piece that we are considering is capable of receiving more variations in extension than I have ever imagined. We must then grant that I could not even understand through the imagination what this piece of wax is, and that it is my mind alone which perceives it. I say this piece of wax in particular, for as to wax in general it is yet clearer. But what is this piece of wax which cannot be understood excepting by the [understanding or] mind? It is certainly the same that I see, touch, imagine, and finally it is the same which I have always believed it to be from the beginning. But what must particularly be observed is that its perception is neither an act of vision, nor of touch, nor of imagination, and has never been such although it may have appeared formerly to be so, but only an intuition of the mind, which may be imperfect and confused as it was formerly, or clear and distinct as it is at present, according as my
attention is more or less directed to the elements which are found in it, and of which it is composed.

Yet in the meantime I am greatly astonished when I consider [the great feebleness of mind] and its proneness to fall [insensibly] into error; for although without giving expression to my thought I consider all this in my own mind, words often impede me and I am almost deceived by the terms of ordinary language. For we say that we see the same wax, if it is present, and not that we simply judge that it is the same from its having the same colour and figure. From this I should conclude that I knew the wax by means of vision and not simply by the intuition of the mind; unless by chance I remember that, when looking from a window and saying I see men who pass in the street, I really do not see them, but infer that what I see is men, just as I say that I see wax. And yet what do I see from the window but hats and coats which may cover automatic machines? Yet I judge these to be men. And similarly solely by the faculty of judgment which rests in my mind, I comprehend that which I believed I saw with my eyes.

A man who makes it his aim to raise his knowledge above the common should be ashamed to derive the occasion for doubting from the forms of speech invented by the vulgar; I prefer to pass on and consider whether I had a more evident and perfect conception of what the wax was when I first perceived it, and when I believed I knew it by means of the external senses or at least by the common sense as it is called, that is to say by the imaginative faculty, or whether my present conception is clearer now that I have most carefully examined what it is, and in what way it can be known. It would certainly be absurd to doubt as to this. For what was there in this first perception which was distinct? What was there which might not as well have been perceived by any of the animals? But when I distinguish the wax from its external forms, and when, just as if I had taken from it its vestments, I consider it quite naked, it is certain that although some error may still be found in my judgment, I can nevertheless not perceive it thus without a human mind.

But finally what shall I say of this mind, that is, of myself, for up to this point I do not admit in myself anything but mind? What then, I who seem to perceive this piece of wax so distinctly, do I not know
myself, not only with much more truth and certainty, but also with much more distinctness and clearness? For if I judge that the wax is or exists from the fact that I see it, it certainly follows much more clearly that I am or that I exist myself from the fact that I see it. For it may be that what I see is not really wax, it may also be that I do not possess eyes with which to see anything; but it cannot be that when I see, or (for I no longer take account of the distinction) when I think I see, that I myself who think am nought. So if I judge that the wax exists from the fact that I touch it, the same thing will follow, to wit, that I am; and if I judge that my imagination, or some other cause, whatever it is, persuades me that the wax exists, I shall still conclude the same. And what I have here remarked of wax may be applied to all other things which are external to me [and which are met with outside of me]. And further, if the [notion or] perception of wax has seemed to me clearer and more distinct, not only after the sight or the touch, but also after many other causes have rendered it quite manifest to me, with how much more [evidence] and distinctness must it be said that I now know myself, since all the reasons which contribute to the knowledge of wax, or any other body whatever, are yet better proofs of the nature of my mind! And there are so many other things in the mind itself which may contribute to the elucidation of its nature, that those which depend on body such as these just mentioned, hardly merit being taken into account.

But finally here I am, having insensibly reverted to the point I desired, for, since it is now manifest to me that even bodies are not properly speaking known by the senses or by the faculty of imagination, but by the understanding only, and since they are not known from the fact that they are seen or touched, but only because they are understood, I see clearly that there is nothing which is easier for me to know than my mind. But because it is difficult to rid oneself so promptly of an opinion to which one was accustomed for so long, it will be well that I should halt a little at this point, so that by the length of my meditation I may more deeply imprint on my memory this new knowledge.
MEDITATION III.

Of God: that He exists.

I shall now close my eyes, I shall stop my ears, I shall call away all my senses, I shall efface even from my thoughts all the images of corporeal things, or at least (for that is hardly possible) I shall esteem them as vain and false; and thus holding converse only with myself and considering my own nature, I shall try little by little to reach a better knowledge of and a more familiar acquaintanceship with myself. I am a thing that thinks, that is to say, that doubts, affirms, denies, that knows a few things, that is ignorant of many [that loves, that hates], that wills, that desires, that also imagines and perceives; for as I remarked before, although the things which I perceive and imagine are perhaps nothing at all apart from me and in themselves, I am nevertheless assured that these modes of thought that I call perceptions and imaginations, inasmuch only as they are modes of thought, certainly reside [and are met with] in me.

And in the little that I have just said, I think I have summed up all that I really know, or at least all that hitherto I was aware that I knew. In order to try to extend my knowledge further, I shall now look around more carefully and see whether I cannot still discover in myself some other things which I have not hitherto perceived. I am certain that I am a thing which thinks; but do I not then likewise know what is requisite to render me certain of a truth? Certainly in this first knowledge there is nothing that assures me of its truth, excepting the clear and distinct perception of that which I state, which would
not indeed suffice to assure me that what I say is true, if it could ever happen that a thing which I conceived so clearly and distinctly could be false; and accordingly it seems to me that already I can establish as a general rule that all things which I perceive very clearly and very distinctly are true.

At the same time I have before received and admitted many things to be very certain and manifest, which yet I afterwards recognised as being dubious. What then were these things? They were the earth, sky, stars and all other objects which I apprehended by means of the senses. But what did I clearly [and distinctly] perceive in them? Nothing more than that the ideas or thoughts of these things were presented to my mind. And not even now do I deny that these ideas are met with in me. But there was yet another thing which I affirmed, and which, owing to the habit which I had formed of believing it, I thought I perceived very clearly, although in truth I did not perceive it at all, to wit, that there were objects outside of me from which these ideas proceeded, and to which they were entirely similar. And it was in this that I erred, or, if perchance my judgment was correct, this was not due to any knowledge arising from my perception.

But when I took anything very simple and easy in the sphere of arithmetic or geometry into consideration, e.g. that two and three together made five, and other things of the sort, were not these present to my mind so clearly as to enable me to affirm that they were true? Certainly if I judged that since such matters could be doubted, this would not have been so for any other reason than that it came into my mind that perhaps a God might have endowed me with such a nature that I may have been deceived even concerning things which seemed to me most manifest. But every time that this preconceived opinion of the sovereign power of a God presents itself to my thought, I am constrained to confess that it is easy to Him, if He wishes it, to cause me to err, even in matters in which I believe myself to have the best evidence. And, on the other hand, always when I direct my attention to things which I believe myself to perceive very clearly, I am so persuaded of their truth that I let myself break out into words such as these: Let who will deceive me, He can never cause me to be nothing while I think that I am, or some day cause it to be true.
to say that I have never been, it being true now to say that I am, or that two and three make more or less than five, or any such thing in which I see a manifest contradiction. And, certainly, since I have no reason to believe that there is a God who is a deceiver, and as I have not yet satisfied myself that there is a God at all, the reason for doubt which depends on this opinion alone is very slight, and so to speak metaphysical. But in order to be able altogether to remove it, I must inquire whether there is a God as soon as the occasion presents itself; and if I find that there is a God, I must also inquire whether He may be a deceiver; for without a knowledge of these two truths I do not see that I can ever be certain of anything.

And in order that I may have an opportunity of inquiring into this in an orderly way [without interrupting the order of meditation which I have proposed to myself, and which is little by little to pass from the notions which I find first of all in my mind to those which I shall later on discover in it] it is requisite that I should here divide my thoughts into certain kinds, and that I should consider in which of these kinds there is, properly speaking, truth or error to be found. Of my thoughts some are, so to speak, images of the things, and to these alone is the title “idea” properly applied; examples are my thought of a man or of a chimera, of heaven, of an angel, or [even] of God. But other thoughts possess other forms as well. For example in willing, fearing, approving, denying, though I always perceive something as the subject of the action of my mind,16 yet by this action I always add something else to the idea17 which I have of that thing; and of the thoughts of this kind some are called volitions or affections, and others judgments.

Now as to what concerns ideas, if we consider them only in themselves and do not relate them to anything else beyond themselves, they cannot properly speaking be false; for whether I imagine a goat or a chimera, it is not less true that I imagine the one that the other. We must not fear likewise that falsity can enter into will and into affections, for although I may desire evil things, or even things that never existed, it is not the less true that I desire them. Thus there remains no more than the judgments which we make, in which I must take the greatest care not to deceive myself. But the principal error and the commonest which we may meet with in them, consists in my judging
that the ideas which are in me are similar or conformable to the things which are outside me; for without doubt if I considered the ideas only as certain modes of my thoughts, without trying to relate them to anything beyond, they could scarcely give me material for error.

But among these ideas, some appear to me to be innate, some adventitious, and others to be formed [or invented] by myself; for, as I have the power of understanding what is called a thing, or a truth, or a thought, it appears to me that I hold this power from no other source than my own nature. But if I now hear some sound, if I see the sun, or feel heat, I have hitherto judged that these sensations proceeded from certain things that exist outside of me; and finally it appears to me that sirens, hippogryphs, and the like, are formed out of my own mind. But again I may possibly persuade myself that all these ideas are of the nature of those which I term adventitious, or else that they are all innate, or all fictitious: for I have not yet clearly discovered their true origin.

And my principal task in this place is to consider, in respect to those ideas which appear to me to proceed from certain objects that are outside me, what are the reasons which cause me to think them similar to these objects. It seems indeed in the first place that I am taught this lesson by nature; and, secondly, I experience in myself that these ideas do not depend on my will nor therefore on myself for they often present themselves to my mind in spite of my will. Just now, for instance, whether I will or whether I do not will, I feel heat, and thus I persuade myself that this feeling, or at least this idea of heat, is produced in me by something which is different from me, i.e. by the heat of the fire near which I sit. And nothing seems to me more obvious than to judge that this object imprints its likeness rather than anything else upon me.

Now I must discover whether these proofs are sufficiently strong and convincing. When I say that I am so instructed by nature, I merely mean a certain spontaneous inclination which impels me to believe in this connection, and not a natural light which makes me recognise that it is true. But these two things are very different; for I cannot doubt that which the natural light causes me to believe to be true, as, for example, it has shown me that I am from the fact that I doubt, or other facts of the same kind. And I possess no other faculty whereby
to distinguish truth from falsehood, which can teach me that what this
light shows me to be true is not really true, and no other faculty that
is equally trustworthy. But as far as [apparently] natural impulses are
concerned, I have frequently remarked, when I had to make active
choice between virtue and vice, that they often enough led me to
the part that was worse; and this is why I do not see any reason for
following them in what regards truth and error.

And as to the other reason, which is that these ideas must proceed
from objects outside me, since they do not depend on my will, I do
not find it any the more convincing. For just as these impulses of
which I have spoken are found in me, notwithstanding that they do
not always concur with my will, so perhaps there is in me some faculty
fitted to produce these ideas without the assistance of any external
things, even though it is not yet known by me; just as, apparently, they
have hitherto always been found in me during sleep without the aid
of any external objects.

And finally, though they did proceed from objects different from
myself, it is not a necessary consequence that they should resemble
these. On the contrary, I have noticed that in many cases there was a
great difference between the object and its idea. I find, for example,
two completely diverse ideas of the sun in my mind; the one derives its
origin from the senses, and should be placed in the category of adven-
titious ideas; according to this idea the sun seems to be extremely
small; but the other is derived from astronomical reasonings, i.e. is
elicted from certain notions that are innate in me, or else it is formed
by me in some other manner; in accordance with it the sun appears
to be several times greater than the earth. These two ideas cannot,
indeed, both resemble the same sun, and reason makes me believe
that the one which seems to have originated directly from the sun
itself, is the one which is most dissimilar to it.

All this causes me to believe that until the present time it has not
been by a judgment that was certain [or premeditated], but only by
a sort of blind impulse that I believed that things existed outside of,
and different from me, which, by the organs of my senses, or by some
other method whatever it might be, conveyed these ideas or images
to me [and imprinted on me their similitudes].

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But there is yet another method of inquiring whether any of the objects of which I have ideas within me exist outside of me. If ideas are only taken as certain modes of thought, I recognise amongst them no difference or inequality, and all appear to proceed from me in the same manner; but when we consider them as images, one representing one thing and the other another, it is clear that they are very different one from the other. There is no doubt that those which represent to me substances are something more, and contain so to speak more objective reality within them [that is to say, by representation participate in a higher degree of being or perfection] than those that simply represent modes or accidents; and that idea again by which I understand a supreme God, eternal, infinite, [immutable], omniscient, omnipotent, and Creator of all things which are outside of Himself, has certainly more objective reality in itself than those ideas by which finite substances are represented.

Now it is manifest by the natural light that there must at least be as much reality in the efficient and total cause as in its effect. For, pray, whence can the effect derive its reality, if not from its cause? And in what way can this cause communicate this reality to it, unless it possessed it in itself? And from this it follows, not only that something cannot proceed from nothing, but likewise that what is more perfect that is to say, which has more reality within itself cannot proceed from the less perfect. And this is not only evidently true of those effects which possess actual or formal reality, but also of the ideas in which we consider merely what is termed objective reality. To take an example, the stone which has not yet existed not only cannot now commence to be unless it has been produced by something which possesses within itself, either formally or eminently, all that enters into the composition of the stone [i.e. it must possess the same things or other more excellent things than those which exist in the stone] and heat can only be produced in a subject in which it did not previously exist by a cause that is of an order [degree or kind] at least as perfect as heat, and so in all other cases. But further, the idea of heat, or of a stone, cannot exist in me unless it has been placed within me by some cause which possesses within it at least as much reality as that which I conceive to exist in the heat or the stone. For although this cause
does not transmit anything of its actual or formal reality to my idea, we must not for that reason imagine that it is necessarily a less real cause; we must remember that [since every idea is a work of the mind] its nature is such that it demands of itself no other formal reality than that which it borrows from my thought, of which it is only a mode [i.e. a manner or way of thinking]. But in order that an idea should contain some one certain objective reality rather than another, it must without doubt derive it from some cause in which there is at least as much formal reality as this idea contains of objective reality. For if we imagine that something is found in an idea which is not found in the cause, it must then have been derived from nought; but however imperfect may be this mode of being by which a thing is objectively [or by representation] in the understanding by its idea, we cannot certainly say that this mode of being is nothing, nor consequently, that the idea derives its origin from nothing.

Nor must I imagine that, since the reality that I consider in these ideas is only objective, it is not essential that this reality should be formally in the causes of my ideas, but that it is sufficient that it should be found objectively. For just as this mode of objective existence pertains to ideas by their proper nature, so does the mode of formal existence pertain to the causes of those ideas (this is at least true of the first and principal) by the nature peculiar to them. And although it may be the case that one idea gives birth to another idea, that cannot continue to be so indefinitely; for in the end we must reach an idea whose cause shall be so to speak an archetype, in which the whole reality [or perfection] which is so to speak objectively [or by representation] in these ideas is contained formally [and really]. Thus the light of nature causes me to know clearly that the ideas in me are like [pictures or] images which can, in truth, easily fall short of the perfection of the objects from which they have been derived, but which can never contain anything greater or more perfect.

And the longer and the more carefully that I investigate these matters, the more clearly and distinctly do I recognise their truth. But what am I to conclude from it all in the end? It is this, that if the objective reality of any one of my ideas is of such a nature as clearly to make me recognise that it is not in me either formally or eminently,
and that consequently I cannot myself be the cause of it, it follows of necessity that I am not alone in the world, but that there is another being which exists, or which is the cause of this idea. On the other hand, had no such an idea existed in me, I should have had no sufficient argument to convince me of the existence of any being beyond myself; for I have made very careful investigation everywhere and up to the present time have been able to find no other ground.

But of my ideas, beyond that which represents me to myself, as to which there can here be no difficulty, there is another which represents a God, and there are others representing corporeal and inanimate things, others angels, others animals, and others again which represent to me men similar to myself.

As regards the ideas which represent to me other men or animals, or angels, I can however easily conceive that they might be formed by an admixture of the other ideas which I have of myself, of corporeal things, and of God, even although there were apart from me neither men nor animals, nor angels, in all the world.

And in regard to the ideas of corporeal objects, I do not recognise in them anything so great or so excellent that they might not have possibly proceeded from myself; for if I consider them more closely, and examine them individually, as I yesterday examined the idea of wax, I find that there is very little in them which I perceive clearly and distinctly. Magnitude or extension in length, breadth, or depth, I do so perceive; also figure which results from a termination of this extension, the situation which bodies of different figure preserve in relation to one another, and movement or change of situation; to which we may also add substance, duration and number. As to other things such as light, colours, sounds, scents, tastes, heat, cold and the other tactile qualities, they are thought by me with so much obscurity and confusion that I do not even know if they are true or false, i.e. whether the ideas which I form of these qualities are actually the ideas of real objects or not [or whether they only represent chimeras which cannot exist in fact]. For although I have before remarked that it is only in judgments that falsity, properly speaking, or formal falsity, can be met with, a certain material falsity may nevertheless be found in ideas, i.e. when these ideas represent what is nothing as though
it were something. For example, the ideas which I have of cold and heat are so far from clear and distinct that by their means I cannot tell whether cold is merely a privation of heat, or heat a privation of cold, or whether both are real qualities, or are not such. And inasmuch as [since ideas resemble images] there cannot be any ideas which do not appear to represent some things, if it is correct to say that cold is merely a privation of heat, the idea which represents it to me as something real and positive will not be improperly termed false, and the same holds good of other similar ideas.

To these it is certainly not necessary that I should attribute any author other than myself. For if they are false, i.e. if they represent things which do not exist, the light of nature shows me that they issue from nought, that is to say, that they are only in me so far as something is lacking to the perfection of my nature. But if they are true, nevertheless because they exhibit so little reality to me that I cannot even clearly distinguish the thing represented from non-being, I do not see any reason why they should not be produced by myself.

As to the clear and distinct idea which I have of corporeal things, some of them seem as though I might have derived them from the idea which I possess of myself, as those which I have of substance, duration, number, and such like. For [even] when I think that a stone is a substance, or at least a thing capable of existing of itself, and that I am a substance also, although I conceive that I am a thing that thinks and not one that is extended, and that the stone on the other hand is an extended thing which does not think, and that thus there is a notable difference between the two conceptions they seem, nevertheless, to agree in this, that both represent substances. In the same way, when I perceive that I now exist and further recollect that I have in former times existed, and when I remember that I have various thoughts of which I can recognise the number, I acquire ideas of duration and number which I can afterwards transfer to any object that I please. But as to all the other qualities of which the ideas of corporeal things are composed, to wit, extension, figure, situation and motion, it is true that they are not formally in me, since I am only a thing that thinks; but because they are merely certain modes of substance [and so to speak the vestments under which corporeal substance appears to us]
and because I myself am also a substance, it would seem that they
might be contained in me eminently.

Hence there remains only the idea of God, concerning which we
must consider whether it is something which cannot have proceeded
from me myself. By the name God I understand a substance that is
infinite [eternal, immutable], independent, all-knowing, all-powerful,
and by which I myself and everything else, if anything else does exist,
have been created. Now all these characteristics are such that the
more diligently I attend to them, the less do they appear capable of
proceeding from me alone; hence, from what has been already said,
we must conclude that God necessarily exists.

For although the idea of substance is within me owing to the fact
that I am substance, nevertheless I should not have the idea of an
infinite substance since I am finite if it had not proceeded from some
substance which was veritably infinite.

Nor should I imagine that I do not perceive the infinite by a true
idea, but only by the negation of the finite, just as I perceive repose
and darkness by the negation of movement and of light; for, on the
contrary, I see that there is manifestly more reality in infinite sub-
stance than in finite, and therefore that in some way I have in me
the notion of the infinite earlier then the finite to wit, the notion of
God before that of myself. For how would it be possible that I should
know that I doubt and desire, that is to say, that something is lacking
to me, and that I am not quite perfect, unless I had within me some
idea of a Being more perfect than myself, in comparison with which
I should recognise the deficiencies of my nature?

And we cannot say that this idea of God is perhaps materially false
and that consequently I can derive it from nought [i.e. that possibly
it exists in me because I am imperfect], as I have just said is the case
with ideas of heat, cold and other such things; for, on the contrary, as
this idea is very clear and distinct and contains within it more objective
reality than any other, there can be none which is of itself more true,
nor any in which there can be less suspicion of falsehood. The idea,
I say, of this Being who is absolutely perfect and infinite, is entirely
true; for although, perhaps, we can imagine that such a Being does
not exist, we cannot nevertheless imagine that His idea represents
nothing real to me, as I have said of the idea of cold. This idea is also very clear and distinct; since all that I conceive clearly and distinctly of the real and the true, and of what conveys some perfection, is in its entirety contained in this idea. And this does not cease to be true although I do not comprehend the infinite, or though in God there is an infinitude of things which I cannot comprehend, nor possibly even reach in any way by thought; for it is of the nature of the infinite that my nature, which is finite and limited, should not comprehend it; and it is sufficient that I should understand this, and that I should judge that all things which I clearly perceive and in which I know that there is some perfection, and possibly likewise an infinitude of properties of which I am ignorant, are in God formally or eminently, so that the idea which I have of Him may become the most true, most clear, and most distinct of all the ideas that are in my mind.

But possibly I am something more than I suppose myself to be, and perhaps all those perfections which I attribute to God are in some way potentially in me, although they do not yet disclose themselves, or issue in action. As a matter of fact I am already sensible that my knowledge increases [and perfects itself] little by little, and I see nothing which can prevent it from increasing more and more into infinitude; nor do I see, after it has thus been increased [or perfected], anything to prevent my being able to acquire by its means all the other perfections of the Divine nature; nor finally why the power I have of acquiring these perfections, if it really exists in me, shall not suffice to produce the ideas of them.

At the same time I recognise that this cannot be. For, in the first place, although it were true that every day my knowledge acquired new degrees of perfection, and that there were in my nature many things potentially which are not yet there actually, nevertheless these excellences do not pertain to [or make the smallest approach to] the idea which I have of God in whom there is nothing merely potential [but in whom all is present really and actually]; for it is an infallible token of imperfection in my knowledge that it increases little by little. and further, although my knowledge grows more and more, nevertheless I do not for that reason believe that it can ever be actually infinite, since it can never reach a point so high that it will be unable to attain
to any greater increase. But I understand God to be actually infinite, so that He can add nothing to His supreme perfection. And finally I perceive that the objective being of an idea cannot be produced by a being that exists potentially only, which properly speaking is nothing, but only by a being which is formal or actual.

To speak the truth, I see nothing in all that I have just said which by the light of nature is not manifest to anyone who desires to think attentively on the subject; but when I slightly relax my attention, my mind, finding its vision somewhat obscured and so to speak blinded by the images of sensible objects, I do not easily recollect the reason why the idea that I possess of a being more perfect than I, must necessarily have been placed in me by a being which is really more perfect; and this is why I wish here to go on to inquire whether I, who have this idea, can exist if no such being exists.

And I ask, from whom do I then derive my existence? Perhaps from myself or from my parents, or from some other source less perfect than God; for we can imagine nothing more perfect than God, or even as perfect as He is.

But [were I independent of every other and] were I myself the author of my being, I should doubt nothing and I should desire nothing, and finally no perfection would be lacking to me; for I should have bestowed on myself every perfection of which I possessed any idea and should thus be God. And it must not be imagined that those things that are lacking to me are perhaps more difficult of attainment than those which I already possess; for, on the contrary, it is quite evident that it was a matter of much greater difficulty to bring to pass that I, that is to say, a thing or a substance that thinks, should emerge out of nothing, than it would be to attain to the knowledge of many things of which I am ignorant, and which are only the accidents of this thinking substance. But it is clear that if I had of myself possessed this greater perfection of which I have just spoken [that is to say, if I had been the author of my own existence], I should not at least have denied myself the things which are the more easy to acquire [to wit, many branches of knowledge of which my nature is destitute]; nor should I have deprived myself of any of the things contained in the idea which I form of God, because there are none of them which seem
to me specially difficult to acquire: and if there were any that were more difficult to acquire, they would certainly appear to me to be such (supposing I myself were the origin of the other things which I possess) since I should discover in them that my powers were limited.

But though I assume that perhaps I have always existed just as I am at present, neither can I escape the force of this reasoning, and imagine that the conclusion to be drawn from this is, that I need not seek for any author of my existence. For all the course of my life may be divided into an infinite number of parts, none of which is in any way dependent on the other; and thus from the fact that I was in existence a short time ago it does not follow that I must be in existence now, unless some cause at this instant, so to speak, produces me anew, that is to say, conserves me. It is as a matter of fact perfectly clear and evident to all those who consider with attention the nature of time, that, in order to be conserved in each moment in which it endures, a substance has need of the same power and action as would be necessary to produce and create it anew, supposing it did not yet exist, so that the light of nature shows us clearly that the distinction between creation and conservation is solely a distinction of the reason.

All that I thus require here is that I should interrogate myself, if I wish to know whether I possess a power which is capable of bringing it to pass that I who now am shall still be in the future; for since I am nothing but a thinking thing, or at least since thus far it is only this portion of myself which is precisely in question at present, if such a power did reside in me, I should certainly be conscious of it. But I am conscious of nothing of the kind, and by this I know clearly that I depend on some being different from myself.

Possibly, however, this being on which I depend is not that which I call God, and I am created either by my parents or by some other cause less perfect than God. This cannot be, because, as I have just said, it is perfectly evident that there must be at least as much reality in the cause as in the effect; and thus since I am a thinking thing, and possess an idea of God within me, whatever in the end be the cause assigned to my existence, it must be allowed that it is likewise a thinking thing and that it possesses in itself the idea of all the perfections which I attribute to God. We may again inquire whether this cause
derives its origin from itself or from some other thing. For if from itself, it follows by the reasons before brought forward, that this cause must itself be God; for since it possesses the virtue of self-existence, it must also without doubt have the power of actually possessing all the perfections of which it has the idea, that is, all those which I conceive as existing in God. But if it derives its existence from some other cause than itself, we shall again ask, for the same reason, whether this second cause exists by itself or through another, until from one step to another, we finally arrive at an ultimate cause, which will be God.

And it is perfectly manifest that in this there can be no regression into infinity, since what is in question is not so much the cause which formerly created me, as that which conserves me at the present time.

Nor can we suppose that several causes may have concurred in my production, and that from one I have received the idea of one of the perfections which I attribute to God, and from another the idea of some other, so that all these perfections indeed exist somewhere in the universe, but not as complete in one unity which is God. On the contrary, the unity, the simplicity or the inseparability of all things which are in God is one of the principal perfections which I conceive to be in Him. And certainly the idea of this unity of all Divine perfections cannot have been placed in me by any cause from which I have not likewise received the ideas of all the other perfections; for this cause could not make me able to comprehend them as joined together in an inseparable unity without having at the same time caused me in some measure to know what they are [and in some way to recognise each one of them].

Finally, so far as my parents [from whom it appears I have sprung] are concerned, although all that I have ever been able to believe of them were true, that does not make it follow that it is they who conserve me, nor are they even the authors of my being in any sense, in so far as I am a thinking being; since what they did was merely to implant certain dispositions in that matter in which the self i.e. the mind, which alone I at present identify with myself is by me deemed to exist. And thus there can be no difficulty in their regard, but we must of necessity conclude from the fact alone that I exist, or that the idea of a Being supremely perfect that is of God is in me, that the proof of God’s existence is grounded on the highest evidence.
It only remains to me to examine into the manner in which I have acquired this idea from God; for I have not received it through the senses, and it is never presented to me unexpectedly, as is usual with the ideas of sensible things when these things present themselves, or seem to present themselves, to the external organs of my senses; nor is it likewise a fiction of my mind, for it is not in my power to take from or to add anything to it; and consequently the only alternative is that it is innate in me, just as the idea of myself is innate in me.

And one certainly ought not to find it strange that God, in creating me, placed this idea within me to be like the mark of the workman imprinted on his work; and it is likewise not essential that the mark shall be something different from the work itself. For from the sole fact that God created me it is most probable that in some way he has placed his image and similitude upon me, and that I perceive this similitude (in which the idea of God is contained) by means of the same faculty by which I perceive myself that is to say, when I reflect on myself I not only know that I am something [imperfect], incomplete and dependent on another, which incessantly aspires after something which is better and greater than myself, but I also know that He on whom I depend possesses in Himself all the great things towards which I aspire [and the ideas of which I find within myself], and that not indefinitely or potentially alone, but really, actually and infinitely; and that thus He is God. And the whole strength of the argument which I have here made use of to prove the existence of God consists in this, that I recognise that it is not possible that my nature should be what it is, and indeed that I should have in myself the idea of a God, if God did not veritably exist a God, I say, whose idea is in me, i.e. who possesses all those supreme perfections of which our mind may indeed have some idea but without understanding them all, who is liable to no errors or defect [and who has none of all those marks which denote imperfection]. From this it is manifest that He cannot be a deceiver, since the light of nature teaches us that fraud and deception necessarily proceed from some defect.

But before I examine this matter with more care, and pass on to the consideration of other truths which may be derived from it, it seems to me right to pause for a while in order to contemplate God
Himself, to ponder at leisure His marvellous attributes, to consider, and admire, and adore, the beauty of this light so resplendent, at least as far as the strength of my mind, which is in some measure dazzled by the sight, will allow me to do so. For just as faith teaches us that the supreme felicity of the other life consists only in this contemplation of the Divine Majesty, so we continue to learn by experience that a similar meditation, though incomparably less perfect, causes us to enjoy the greatest satisfaction of which we are capable in this life.
MEDITATION IV.

Of the True and the False.

I have been well accustomed these past days to detach my mind from my senses, and I have accurately observed that there are very few things that one knows with certainty respecting corporeal objects, that there are many more which are known to us respecting the human mind, and yet more still regarding God Himself; so that I shall now without any difficulty abstract my thoughts from the consideration of [sensible or] imaginable objects, and carry them to those which, being withdrawn from all contact with matter, are purely intelligible. And certainly the idea which I possess of the human mind inasmuch as it is a thinking thing, and not extended in length, width and depth, nor participating in anything pertaining to body, is incomparably more distinct than is the idea of any corporeal thing. And when I consider that I doubt, that is to say, that I am an incomplete and dependent being, the idea of a being that is complete and independent, that is of God, presents itself to my mind with so much distinctness and clearness and from the fact alone that this idea is found in me, or that I who possess this idea exist, I conclude so certainly that God exists, and that my existence depends entirely on Him in every moment of my life that I do not think that the human mind is capable of knowing anything with more evidence and certitude. And it seems to me that I now have before me a road which will lead us from the contemplation of the true God (in whom all the treasures of science and wisdom are contained) to the knowledge of the other objects of the universe.
For, first of all, I recognise it to be impossible that He should ever
deceive me; for in all fraud and deception some imperfection is to be
found, and although it may appear that the power of deception is a
mark of subtility or power, yet the desire to deceive without doubt testi-
fies to malice or feebleness, and accordingly cannot be found in God.

In the next place I experienced in myself a certain capacity for
judging which I have doubtless received from God, like all the other
things that I possess; and as He could not desire to deceive me, it is
clear that He has not given me a faculty that will lead me to err if I
use it aright.

And no doubt respecting this matter could remain, if it were not
that the consequence would seem to follow that I can thus never be
deceived; for if I hold all that I possess from God, and if He has not
placed in me the capacity for error, it seems as though I could never
fall into error. And it is true that when I think only of God [and
direct my mind wholly to Him], I discover [in myself] no cause
of error, or falsity; yet directly afterwards, when recurring to myself,
experience shows me that I am nevertheless subject to an infinitude
of errors, as to which, when we come to investigate them more closely,
I notice that not only is there a real and positive idea of God or of
a Being of supreme perfection present to my mind, but also, so to
speak, a certain negative idea of nothing, that is, of that which is
infinitely removed from any kind of perfection; and that I am in a
sense something intermediate between God and nought, i.e. placed
in such a manner between the supreme Being and non-being, that
there is in truth nothing in me that can lead to error in so far as a sov-
eign Being has formed me; but that, as I in some degree participate
likewise in nought or in non-being, i.e. in so far as I am not myself
the supreme Being, and as I find myself subject to an infinitude of
imperfections, I ought not to be astonished if I should fall into error.
Thus do I recognise that error, in so far as it is such, is not a real thing
dependning on God, but simply a defect; and therefore, in order to
fall into it, that I have no need to possess a special faculty given me by
God for this very purpose, but that I fall into error from the fact that
the power given me by God for the purpose of distinguishing truth
from error is not infinite.
Nevertheless this does not quite satisfy me; for error is not a pure negation [i.e. is not the dimple defect or want of some perfection which ought not to be mine], but it is a lack of some knowledge which it seems that I ought to possess. And on considering the nature of God it does not appear to me possible that He should have given me a faculty which is not perfect of its kind, that is, which is wanting in some perfection due to it. For if it is true that the more skilful the artizan, the more perfect is the work of his hands, what can have been produced by this supreme Creator of all things that is not in all its parts perfect? And certainly there is no doubt that God could have created me so that I could never have been subject to error; it is also certain that He ever wills what is best; is it then better that I should be subject to err than that I should not?

In considering this more attentively, it occurs to me in the first place that I should not be astonished if my intelligence is not capable of comprehending why God acts as He does; and that there is thus no reason to doubt of His existence from the fact that I may perhaps find many other things besides this as to which I am able to understand neither for what reason nor how God has produced them. For, in the first place, knowing that my nature is extremely feeble and limited, and that the nature of God is on the contrary immense, incomprehensible, and infinite, I have no further difficulty in recognising that there is an infinitude of matter in His power, the causes of which transcend my knowledge; and this reason suffices to convince me that the species of cause termed final, finds no useful employment in physical [or natural] things; for it does not appear to me that I can without temerity seek to investigate the [inscrutable] ends of God.

It further occurs to me that we should not consider one single creature separately, when we inquire as to whether the works of God are perfect, but should regard all his creations together. For the same thing which might possibly seem very imperfect with some semblance of reason if regarded by itself, is found to be very perfect if regarded as part of the whole universe; and although, since I resolved to doubt all things, I as yet have only known certainly my own existence and that of God, nevertheless since I have recognised the infinite power of God, I cannot deny that He may have produced many other things,
or at least that He has the power of producing them, so that I may obtain a place as a part of a great universe.

Whereupon, regarding myself more closely, and considering what are my errors (for they alone testify to there being any imperfection in me), I answer that they depend on a combination of two causes, to wit, on the faculty of knowledge that rests in me, and on the power of choice or of free will that is to say, of the understanding and at the same time of the will. For by the understanding alone I [neither assert nor deny anything, but] apprehend the ideas of things as to which I can form a judgment. But no error is properly speaking found in it, provided the word error is taken in its proper signification; and though there is possibly an infinitude of things in the world of which I have no idea in my understanding, we cannot for all that say that it is deprived of these ideas [as we might say of something which is required by its nature], but simply it does not possess these; because in truth there is no reason to prove that God should have given me a greater faculty of knowledge than He has given me; and however skillful a workman I represent Him to be, I should not for all that consider that He was bound to have placed in each of His works all the perfections which He may have been able to place in some. I likewise cannot complain that God has not given me a free choice or a will which is sufficient, ample and perfect, since as a matter of fact I am conscious of a will so extended as to be subject to no limits. And what seems to me very remarkable in this regard is that of all the qualities which I possess there is no one so perfect and so comprehensive that I do not very clearly recognise that it might be yet greater and more perfect. For, to take an example, if I consider the faculty of comprehension which I possess, I find that it is of very small extent and extremely limited, and at the same time I find the idea of another faculty much more ample and even infinite, and seeing that I can form the idea of it, I recognise from this very fact that it pertains to the nature of God. If in the same way I examine the memory, the imagination, or some other faculty, I do not find any which is not small and circumscribed, while in God it is immense [or infinite]. It is free-will alone or liberty of choice which I find to be so great in me that I can conceive no other idea to be more great; it is indeed the case that it is for the most
part this will that causes me to know that in some manner I bear the image and similitude of God. For although the power of will is incomparably greater in God than in me, both by reason of the knowledge and the power which, conjoined with it, render it stronger and more efficacious, and by reason of its object, inasmuch as in God it extends to a great many things; it nevertheless does not seem to me greater if I consider it formally and precisely in itself: for the faculty of will consists alone in our having the power of choosing to do a thing or choosing not to do it (that is, to affirm or deny, to pursue or to shun it), or rather it consists alone in the fact that in order to affirm or deny, pursue or shun those things placed before us by the understanding, we act so that we are unconscious that any outside force constrains us in doing so. For in order that I should be free it is not necessary that I should be indifferent as to the choice of one or the other of two contraries; but contrariwise the more I lean to the one whether I recognise clearly that the reasons of the good and true are to be found in it, or whether God so disposes my inward thought the more freely do I choose and embrace it. And undoubtedly both divine grace and natural knowledge, far from diminishing my liberty, rather increase it and strengthen it. Hence this indifference which I feel, when I am not swayed to one side rather than to the other by lack of reason, is the lowest grade of liberty, and rather evinces a lack or negation in knowledge than a perfection of will: for if I always recognised clearly what was true and good, I should never have trouble in deliberating as to what judgment or choice I should make, and then I should be entirely free without ever being indifferent.

From all this I recognise that the power of will which I have received from God is not of itself the source of my errors for it is very ample and very perfect of its kind any more than is the power of understanding; for since I understand nothing but by the power which God has given me for understanding, there is no doubt that all that I understand, I understand as I ought, and it is not possible that I err in this. Whence then come my errors? They come from the sole fact that since the will is much wider in its range and compass than the understanding, I do not restrain it within the same bounds, but extend it also to things which I do not understand: and as the will
is of itself indifferent to these, it easily falls into error and sin, and chooses the evil for the good, or the false for the true.

For example, when I lately examined whether anything existed in the world, and found that from the very fact that I considered this question it followed very clearly that I myself existed, I could not prevent myself from believing that a thing I so clearly conceived was true: not that I found myself compelled to do so by some external cause, but simply because from great clearness in my mind there followed a great inclination of my will; and I believed this with so much the greater freedom or spontaneity as I possessed the less indifference towards it. Now, on the contrary, I not only know that I exist, inasmuch as I am a thinking thing, but a certain representation of corporeal nature is also presented to my mind; and it comes to pass that I doubt whether this thinking nature which is in me, or rather by which I am what I am, differs from this corporeal nature, or whether both are not simply the same thing; and I here suppose that I do not yet know any reason to persuade me to adopt the one belief rather than the other. From this it follows that I am entirely indifferent as to which of the two I affirm or deny, or even whether I abstain from forming any judgment in the matter.

And this indifference does not only extend to matters as to which the understanding has no knowledge, but also in general to all those which are not apprehended with perfect clearness at the moment when the will is deliberating upon them: for, however probable are the conjectures which render me disposed to form a judgment respecting anything, the simple knowledge that I have that those are conjectures alone and not certain and indubitable reasons, suffices to occasion me to judge the contrary. Of this I have had great experience of late when I set aside as false all that I had formerly held to be absolutely true, for the sole reason that I remarked that it might in some measure be doubted.

But if I abstain from giving my judgment on any thing when I do not perceive it with sufficient clearness and distinctness, it is plain that I act rightly and am not deceived. But if I determine to deny or affirm, I no longer make use as I should of my free will, and if I affirm what is not true, it is evident that I deceive myself; even though
I judge according to truth, this comes about only by chance, and I do not escape the blame of misusing my freedom; for the light of nature teaches us that the knowledge of the understanding should always precede the determination of the will. And it is in the misuse of the free will that the privation which constitutes the characteristic nature of error is met with. Privation, I say, is found in the act, in so far as it proceeds from me, but it is not found in the faculty which I have received from God, nor even in the act in so far as it depends on Him.

For I have certainly no cause to complain that God has not given me an intelligence which is more powerful, or a natural light which is stronger than that which I have received from Him, since it is proper to the finite understanding not to comprehend a multitude of things, and it is proper to a created understanding to be finite; on the contrary, I have every reason to render thanks to God who owes me nothing and who has given me all the perfections I possess, and I should be far from charging Him with injustice, and with having deprived me of, or wrongfully withheld from me, these perfections which He has not bestowed upon me.

I have further no reason to complain that He has given me a will more ample than my understanding, for since the will consists only of one single element, and is so to speak indivisible, it appears that its nature is such that nothing can be abstracted from it [without destroying it]; and certainly the more comprehensive it is found to be, the more reason I have to render gratitude to the giver.

And, finally, I must also not complain that God concurs with me in forming the acts of the will, that is the judgment in which I go astray, because these acts are entirely true and good, inasmuch as they depend on God; and in a certain sense more perfection accrues to my nature from the fact that I can form them, than if I could not do so. As to the privation in which alone the formal reason of error or sin consists, it has no need of any concurrence from God, since it is not a thing [or an existence], and since it is not related to God as to a cause, but should be termed merely a negation [according to the significance given to these words in the Schools]. For in fact it is not an imperfection in God that He has given me the liberty to give or withhold my assent from certain things as to which He has not placed
a clear and distinct knowledge in my understanding; but it is without
doubt an imperfection in me not to make a good use of my freedom,
and to give my judgment readily on matters which I only understand
obscurely. I nevertheless perceive that God could easily have created
me so that I never should err, although I still remained free, and
endowed with a limited knowledge, viz. by giving to my understanding
a clear and distinct intelligence of all things as to which I should ever
have to deliberate; or simply by His engraving deeply in my memory
the resolution never to form a judgment on anything without having
a clear and distinct understanding of it, so that I could never forget it.

And it is easy for me to understand that, in so far as I consider myself
alone, and as if there were only myself in the world, I should have
been much more perfect than I am, if God had created me so that I
could never err. Nevertheless I cannot deny that in some sense it is
a greater perfection in the whole universe that certain parts should
not be exempt from error as others are than that all parts should be
exactly similar. And I have no right to complain if God, having placed
me in the world, has not called upon me to play a part that excels all
others in distinction and perfection.

And further I have reason to be glad on the ground that if He
has not given me the power of never going astray by the first means
pointed out above, which depends on a clear and evident knowledge
of all the things regarding which I can deliberate, He has at least
left within my power the other means, which is firmly to adhere to
the resolution never to give judgment on matters whose truth is not
clearly known to me; for although I notice a certain weakness in my
nature in that I cannot continually concentrate my mind on one
single thought, I can yet, by attentive and frequently repeated med-
itation, impress it so forcibly on my memory that I shall never fail to
recollect it whenever I have need of it, and thus acquire the habit of
never going astray.

And inasmuch as it is in this that the greatest and principal per-
fection of man consists, it seems to me that I have not gained little by
this day’s Meditation, since I have discovered the source of falsity and
error. And certainly there can be no other source than that which I
have explained; for as often as I so restrain my will within the limits
of my knowledge that it forms no judgment except on matters which are clearly and distinctly represented to it by the understanding, I can never be deceived; for every clear and distinct conception\(^{20}\) is without doubt something, and hence cannot derive its origin from what is nought, but must of necessity have God as its author. God, I say, who being supremely perfect, cannot be the cause of any error; and consequently we must conclude that such a conception [or such a judgment] is true. Nor have I only learned to-day what I should avoid in order that I may not err, but also how I should act in order to arrive at a knowledge of the truth; for without doubt I shall arrive at this end if I devote my attention sufficiently to those things which I perfectly understand; and if I separate from these that which I only understand confusedly and with obscurity. To these I shall henceforth diligently give heed.
Meditation V.

Of the essence of material things, and, again, of God, that He exists.

Many other matters respecting the attributes of God and my own nature or mind remain for consideration; but I shall possibly on another occasion resume the investigation of these. Now (after first noting what must be done or avoided, in order to arrive at a knowledge of the truth) my principal task is to endeavour to emerge from the state of doubt into which I have these last days fallen, and to see whether nothing certain can be known regarding material things.

But before examining whether any such objects as I conceive exist outside of me, I must consider the ideas of them in so far as they are in my thought, and see which of them are distinct and which confused.

In the first place, I am able distinctly to imagine that quantity which philosophers commonly call continuous, or the extension in length, breadth, or depth, that is in this quantity, or rather in the object to which it is attributed. Further, I can number in it many different parts, and attribute to each of its parts many sorts of size, figure, situation and local movement, and, finally, I can assign to each of these movements all degrees of duration.

And not only do I know these things with distinctness when I consider them in general, but, likewise [however little I apply my attention to the matter], I discover an infinitude of particulars respecting numbers, figures, movements, and other such things, whose truth is so manifest, and so well accords with my nature, that when I begin to discover them, it seems to me that I learn nothing new, or recollect
what I formerly knew that is to say, that I for the first time perceive things which were already present to my mind, although I had not as yet applied my mind to them.

And what I here find to be most important is that I discover in myself an infinitude of ideas of certain things which cannot be esteemed as pure negations, although they may possibly have no existence outside of my thought, and which are not framed by me, although it is within my power either to think or not to think them, but which possess natures which are true and immutable. For example, when I imagine a triangle, although there may nowhere in the world be such a figure outside my thought, or ever have been, there is nevertheless in this figure a certain determinate nature, form, or essence, which is immutable and eternal, which I have not invented, and which in no wise depends on my mind, as appears from the fact that diverse properties of that triangle can be demonstrated, viz. that its three angles are equal to two right angles, that the greatest side is subtended by the greatest angle, and the like, which now, whether I wish it or do not wish it, I recognise very clearly as pertaining to it, although I never thought of the matter at all when I imagined a triangle for the first time, and which therefore cannot be said to have been invented by me.

Nor does the objection hold good that possibly this idea of a triangle has reached my mind through the medium of my senses, since I have sometimes seen bodies triangular in shape; because I can form in my mind an infinitude of other figures regarding which we cannot have the least conception of their ever having been objects of sense, and I can nevertheless demonstrate various properties pertaining to their nature as well as to that of the triangle, and these must certainly all be true since I conceive them clearly. Hence they are something, and not pure negation; for it is perfectly clear that all that is true is something, and I have already fully demonstrated that all that I know clearly is true. And even although I had not demonstrated this, the nature of my mind is such that I could not prevent myself from holding them to be true so long as I conceive them clearly; and I recollect that even when I was still strongly attached to the objects of sense, I counted as the most certain those truths which I conceived clearly as regards
figures, numbers, and the other matters which pertain to arithmetic and geometry, and, in general, to pure and abstract mathematics.

But now, if just because I can draw the idea of something from my thought, it follows that all which I know clearly and distinctly as pertaining to this object does really belong to it, may I not derive from this an argument demonstrating the existence of God? It is certain that I no less find the idea of God, that is to say, the idea of a supremely perfect Being, in me, than that of any figure or number whatever it is; and I do not know any less clearly and distinctly that an [actual and] eternal existence pertains to this nature than I know that all that which I am able to demonstrate of some figure or number truly pertains to the nature of this figure or number, and therefore, although all that I concluded in the preceding Meditations were found to be false, the existence of God would pass with me as at least as certain as I have ever held the truths of mathematics (which concern only numbers and figures) to be.

This indeed is not at first manifest, since it would seem to present some appearance of being a sophism. For being accustomed in all other things to make a distinction between existence and essence, I easily persuade myself that the existence can be separated from the essence of God, and that we can thus conceive God as not actually existing. But, nevertheless, when I think of it with more attention, I clearly see that existence can no more be separated from the essence of God than can its having its three angles equal to two right angles be separated from the essence of a [rectilinear] triangle, or the idea of a mountain from the idea of a valley; and so there is not any less repugnance to our conceiving a God (that is, a Being supremely perfect) to whom existence is lacking (that is to say, to whom a certain perfection is lacking), than to conceive of a mountain which has no valley.

But although I cannot really conceive of a God without existence any more than a mountain without a valley, still from the fact that I conceive of a mountain with a valley, it does not follow that there is such a mountain in the world; similarly although I conceive of God as possessing existence, it would seem that it does not follow that there is a God which exists; for my thought does not impose any necessity upon things, and just as I may imagine a winged horse, although no
horse with wings exists, so I could perhaps attribute existence to God, although no God existed.

But a sophism is concealed in this objection; for from the fact that I cannot conceive a mountain without a valley, it does not follow that there is any mountain or any valley in existence, but only that the mountain and the valley, whether they exist or do not exist, cannot in any way be separated one from the other. While from the fact that I cannot conceive God without existence, it follows that existence is inseparable from Him, and hence that He really exists; not that my thought can bring this to pass, or impose any necessity on things, but, on the contrary, because the necessity which lies in the thing itself, i.e. the necessity of the existence of God determines me to think in this way. For it is not within my power to think of God without existence (that is of a supremely perfect Being devoid of a supreme perfection) though it is in my power to imagine a horse either with wings or without wings.

And we must not here object that it is in truth necessary for me to assert that God exists after having presupposed that He possesses every sort of perfection, since existence is one of these, but that as a matter of fact my original supposition was not necessary, just as it is not necessary to consider that all quadrilateral figures can be inscribed in the circle; for supposing I thought this, I should be constrained to admit that the rhombus might be inscribed in the circle since it is a quadrilateral figure, which, however, is manifestly false. [We must not, I say, make any such allegations because] although it is not necessary that I should at any time entertain the notion of God, nevertheless whenever it happens that I think of a first and a sovereign Being, and, so to speak, derive the idea of Him from the storehouse of my mind, it is necessary that I should attribute to Him every sort of perfection, although I do not get so far as to enumerate them all, or to apply my mind to each one in particular. And this necessity suffices to make me conclude (after having recognised that existence is a perfection) that this first and sovereign Being really exists; just as though it is not necessary for me ever to imagine any triangle, yet, whenever I wish to consider a rectilinear figure composed only of three angles, it is absolutely essential that I should attribute to it all those properties
which serve to bring about the conclusion that its three angles are not greater than two right angles, even although I may not then be considering this point in particular. But when I consider which figures are capable of being inscribed in the circle, it is in no wise necessary that I should think that all quadrilateral figures are of this number; on the contrary, I cannot even pretend that this is the case, so long as I do not desire to accept anything which I cannot conceive clearly and distinctly. And in consequence there is a great difference between the false suppositions such as this, and the true ideas born within me, the first and principal of which is that of God. For really I discern in many ways that this idea is not something factitious, and depending solely on my thought, but that it is the image of a true and immutable nature; first of all, because I cannot conceive anything but God himself to whose essence existence [necessarily] pertains; in the second place because it is not possible for me to conceive two or more Gods in this same position; and, granted that there is one such God who now exists, I see clearly that it is necessary that He should have existed from all eternity, and that He must exist eternally; and finally, because I know an infinitude of other properties in God, none of which I can either diminish or change.

For the rest, whatever proof or argument I avail myself of, we must always return to the point that it is only those things which we conceive clearly and distinctly that have the power of persuading me entirely. And although amongst the matters which I conceive of in this way, some indeed are manifestly obvious to all, while others only manifest themselves to those who consider them closely and examine them attentively; still, after they have once been discovered, the latter are not esteemed as any less certain than the former. For example, in the case of every right-angled triangle, although it does not so manifestly appear that the square of the base is equal to the squares of the two other sides as that this base is opposite to the greatest angle; still, when this has once been apprehended, we are just as certain of its truth as of the truth of the other. And as regards God, if my mind were not pre-occupied with prejudices, and if my thought did not find itself on all hands diverted by the continual pressure of sensible things, there would be nothing which I could know more immediately
and more easily than Him. For is there anything more manifest than that there is a God, that is to say, a Supreme Being, to whose essence alone existence pertains?21

And although for a firm grasp of this truth I have need of a strenuous application of mind, at present I not only feel myself to be as assured of it as of all that I hold as most certain, but I also remark that the certainty of all other things depends on it so absolutely, that without this knowledge it is impossible ever to know anything perfectly.

For although I am of such a nature that as long as I understand anything very clearly and distinctly, I am naturally impelled to believe it to be true, yet because I am also of such a nature that I cannot have my mind constantly fixed on the same object in order to perceive it clearly, and as I often recollect having formed a past judgment without at the same time properly recollecting the reasons that led me to make it, it may happen meanwhile that other reasons present themselves to me, which would easily cause me to change my opinion, if I were ignorant of the facts of the existence of God, and thus I should have no true and certain knowledge, but only vague and vacillating opinions. Thus, for example, when I consider the nature of a [rectilinear] triangle, I who have some little knowledge of the principles of geometry recognise quite clearly that the three angles are equal to two right angles, and it is not possible for me not to believe this so long as I apply my mind to its demonstration; but so soon as I abstain from attending to the proof, although I still recollect having clearly comprehended it, it may easily occur that I come to doubt its truth, if I am ignorant of there being a God. For I can persuade myself of having been so constituted by nature that I can easily deceive myself even in those matters which I believe myself to apprehend with the greatest evidence and certainty, especially when I recollect that I have frequently judged matters to be true and certain which other reasons have afterwards impelled me to judge to be altogether false.

But after I have recognised that there is a God because at the same time I have also recognised that all things depend upon Him, and that He is not a deceiver, and from that have inferred that what I perceive clearly and distinctly cannot fail to be true although I no longer pay attention to the reasons for which I have judged this to be
true, provided that I recollect having clearly and distinctly perceived it no contrary reason can be brought forward which could ever cause me to doubt of its truth; and thus I have a true and certain knowledge of it. And this same knowledge extends likewise to all other things which I recollect having formerly demonstrated, such as the truths of geometry and the like; for what can be alleged against them to cause me to place them in doubt? Will it be said that my nature is such as to cause me to be frequently deceived? But I already know that I cannot be deceived in the judgment whose grounds I know clearly. Will it be said that I formerly held many things to be true and certain which I have afterwards recognised to be false? But I had not had any clear and distinct knowledge of these things, and not as yet knowing the rule whereby I assure myself of the truth, I had been impelled to give my assent from reasons which I have since recognised to be less strong than I had at the time imagined them to be. What further objection can then be raised? That possibly I am dreaming (an objection I myself made a little while ago), or that all the thoughts which I now have are no more true than the phantasies of my dreams? But even though I slept the case would be the same, for all that is clearly present to my mind is absolutely true.

And so I very clearly recognise that the certainty and truth of all knowledge depends alone on the knowledge of the true God, in so much that, before I knew Him, I could not have a perfect knowledge of any other thing. And now that I know Him I have the means of acquiring a perfect knowledge of an infinitude of things, not only of those which relate to God Himself and other intellectual matters, but also of those which pertain to corporeal nature in so far as it is the object of pure mathematics [which have no concern with whether it exists or not].
MEDITATION VI.

Of the Existence of Material Things, and of the real distinction between the Soul and Body of Man.

Nothing further now remains but to inquire whether material things exist. And certainly I at least know that these may exist in so far as they are considered as the objects of pure mathematics, since in this aspect I perceive them clearly and distinctly. For there is no doubt that God possesses the power to produce everything that I am capable of perceiving with distinctness, and I have never deemed that anything was impossible for Him, unless I found a contradiction in attempting to conceive it clearly. Further, the faculty of imagination which I possess, and of which, experience tells me, I make use when I apply myself to the consideration of material things, is capable of persuading me of their existence; for when I attentively consider what imagination is, I find that it is nothing but a certain application of the faculty of knowledge to the body which is immediately present to it, and which therefore exists.

And to render this quite clear, I remark in the first place the difference that exists between the imagination and pure intellection [or conception]. For example, when I imagine a triangle, I do not conceive it only as a figure comprehended by three lines, but I also apprehend these three lines as present by the power and inward vision of my mind, and this is what I call imagining. But if I desire to think of a chiliagon, I certainly conceive truly that it is a figure composed of a thousand sides, just as easily as I conceive of a
triangle that it is a figure of three sides only; but I cannot in any way imagine the thousand sides of a chiliagon [as I do the three sides of a triangle], nor do I, so to speak, regard them as present [with the eyes of my mind]. And although in accordance with the habit I have formed of always employing the aid of my imagination when I think of corporeal things, it may happen that in imagining a chiliagon I confusedly represent to myself some figure, yet it is very evident that this figure is not a chiliagon, since it in no way differs from that which I represent to myself when I think of a myriagon or any other many-sided figure; nor does it serve my purpose in discovering the properties which go to form the distinction between a chiliagon and other polygons. But if the question turns upon a pentagon, it is quite true that I can conceive its figure as well as that of a chiliagon without the help of my imagination; but I can also imagine it by applying the attention of my mind to each of its five sides, and at the same time to the space which they enclose. And thus I clearly recognise that I have need of a particular effort of mind in order to effect the act of imagination, such as I do not require in order to understand, and this particular effort of mind clearly manifests the difference which exists between imagination and pure intellection.26

I remark besides that this power of imagination which is in one, inasmuch as it differs from the power of understanding, is in no wise a necessary element in my nature, or in [my essence, that is to say, in] the essence of my mind; for although I did not possess it I should doubtless ever remain the same as I now am, from which it appears that we might conclude that it depends on something which differs from me. And I easily conceive that if some body exists with which my mind is conjoined and united in such a way that it can apply itself to consider it when it pleases, it may be that by this means it can imagine corporeal objects; so that this mode of thinking differs from pure intellection only inasmuch as mind in its intellectual activity in some manner turns on itself, and considers some of the ideas which it possesses in itself; while in imagining it turns towards the body, and there beholds in it something conformable to the idea which it has either conceived of itself or perceived by the senses. I easily understand, I say, that the imagination could be thus constituted if it is true that body exists; and
because I can discover no other convenient mode of explaining it, I conjecture with probability that body does exist; but this is only with probability, and although I examine all things with care, I nevertheless do not find that from this distinct idea of corporeal nature, which I have in my imagination, I can derive any argument from which there will necessarily be deduced the existence of body.

But I am in the habit of imagining many other things besides this corporeal nature which is the object of pure mathematics, to wit, the colours, sounds, scents, pain, and other such things, although less distinctly. And inasmuch as I perceive these things much better through the senses, by the medium of which, and by the memory, they seem to have reached my imagination, I believe that, in order to examine them more conveniently, it is right that I should at the same time investigate the nature of sense perception, and that I should see if from the ideas which I apprehend by this mode of thought, which I call feeling, I cannot derive some certain proof of the existence of corporeal objects.

And first of all I shall recall to my memory those matters which I hitherto held to be true, as having perceived them through the senses, and the foundations on which my belief has rested; in the next place I shall examine the reasons which have since obliged me to place them in doubt; in the last place I shall consider which of them I must now believe.

First of all, then, I perceived that I had a head, hands, feet, and all other members of which this body which I considered as a part, or possibly even as the whole, of myself is composed. Further I was sensible that this body was placed amidst many others, from which it was capable of being affected in many different ways, beneficial and hurtful, and I remarked that a certain feeling of pleasure accompanied those that were beneficial, and pain those which were harmful. And in addition to this pleasure and pain, I also experienced hunger, thirst, and other similar appetites, as also certain corporeal inclinations towards joy, sadness, anger, and other similar passions. And outside myself, in addition to extension, figure, and motions of bodies, I remarked in them hardness, heat, and all other tactile qualities, and, further, light and colour, and scents and sounds, the variety of which gave me the
means of distinguishing the sky, the earth, the sea, and generally all
the other bodies, one from the other. And certainly, considering the
ideas of all these qualities which presented themselves to my mind,
and which alone I perceived properly or immediately, it was not with-
out reason that I believed myself to perceive objects quite different
from my thought, to wit, bodies from which those ideas proceeded;
for I found by experience that these ideas presented themselves to
me without my consent being requisite, so that I could not perceive
any object, however desirous I might be, unless it were present to the
organs of sense; and it was not in my power not to perceive it, when
it was present. And because the ideas which I received through the
senses were much more lively, more clear, and even, in their own
way, more distinct than any of those which I could of myself frame
in meditation, or than those I found impressed on my memory, it
appeared as though they could not have proceeded from my mind,
so that they must necessarily have been produced in me by some
other things. And having no knowledge of those objects excepting
the knowledge which the ideas themselves gave me, nothing was more
likely to occur to my mind than that the objects were similar to the
ideas which were caused. And because I likewise remembered that I
had formerly made use of my senses rather than my reason, and rec-
ognised that the ideas which I formed of myself were not so distinct
as those which I perceived through the senses, and that they were
most frequently even composed of portions of these last, I persuaded
myself easily that I had no idea in my mind which had not formerly
come to me through the senses. Nor was it without some reason that
I believed that this body (which be a certain special right I call my
own) belonged to me more properly and more strictly than any other;
for in fact I could never be separated from it as from other bodies; I
experienced in it and on account of it all my appetites and affections,
and finally I was touched by the feeling of pain and the titillation of
pleasure in its parts, and not in the parts of other bodies which were
separated from it. But when I inquired, why, from some, I know not
what, painful sensation, there follows sadness of mind, and from the
pleasurable sensation there arises joy, or why this mysterious pinching
of the stomach which I call hunger causes me to desire to eat, and
dryness of throat causes a desire to drink, and so on, I could give no reason excepting that nature taught me so; for there is certainly no affinity (that I at least can understand) between the craving of the stomach and the desire to eat, any more than between the perception of whatever causes pain and the thought of sadness which arises from this perception. And in the same way it appeared to me that I had learned from nature all the other judgments which I formed regarding the objects of my senses, since I remarked that these judgments were formed in me before I had the leisure to weigh and consider any reasons which might oblige me to make them.

But afterwards many experiences little by little destroyed all the faith which I had rested in my senses; for I from time to time observed that those towers which from afar appeared to me to be round, more closely observed seemed square, and that colossal statues raised on the summit of these towers, appeared as quite tiny statues when viewed from the bottom; and so in an infinitude of other cases I found error in judgments founded on the external senses. And not only in those founded on the external senses, but even in those founded on the internal as well; for is there anything more intimate or more internal than pain? And yet I have learned from some persons whose arms or legs have been cut off, that they sometimes seemed to feel pain in the part which had been amputated, which made me think that I could not be quite certain that it was a certain member which pained me, even although I felt pain in it. And to those grounds of doubt I have lately added two others, which are very general; the first is that I never have believed myself to feel anything in waking moments which I cannot also sometimes believe myself to feel when I sleep, and as I do not think that these things which I seem to feel in sleep, proceed from objects outside of me, I do not see any reason why I should have this belief regarding objects which I seem to perceive while awake. The other was that being still ignorant, or rather supposing myself to be ignorant, of the author of my being, I saw nothing to prevent me from having been so constituted by nature that I might be deceived even in matters which seemed to me to be most certain. And as to the grounds on which I was formerly persuaded of the truth of sensible objects, I had not much trouble in replying to them. For since
nature seemed to cause me to lean towards many things from which reason repelled me, I did not believe that I should trust much to the teachings of nature. And although the ideas which I receive by the senses do not depend on my will, I did not think that one should for that reason conclude that they proceeded from things different from myself, since possibly some faculty might be discovered in me though hitherto unknown to me which produced them.

But now that I begin to know myself better, and to discover more clearly the author of my being, I do not in truth think that I should rashly admit all the matters which the senses seem to teach us, but, on the other hand, I do not think that I should doubt them all universally.

And first of all, because I know that all things which I apprehend clearly and distinctly can be created by God as I apprehend them, it suffices that I am able to apprehend one thing apart from another clearly and distinctly in order to be certain that the one is different from the other, since they may be made to exist in separation at least by the omnipotence of God; and it does not signify by what power this separation is made in order to compel me to judge them to be different: and, therefore, just because I know certainly that I exist, and that meanwhile I do not remark that any other thing necessarily pertains to my nature or essence, excepting that I am a thinking thing, I rightly conclude that my essence consists solely in the fact that I am a thinking thing [or a substance whose whole essence or nature is to think]. And although possibly (or rather certainly, as I shall say in a moment) I possess a body with which I am very intimately conjoined, yet because, on the one side, I have a clear and distinct idea of myself inasmuch as I am only a thinking and unextended thing, and as, on the other, I possess a distinct idea of body, inasmuch as it is only an extended and unthinking thing, it is certain that this I [that is to say, my soul by which I am what I am], is entirely and absolutely distinct from my body, and can exist without it.

I further find in myself faculties employing modes of thinking peculiar to themselves, to wit, the faculties of imagination and feeling, without which I can easily conceive myself clearly and distinctly as a complete being; while, on the other hand, they cannot be so conceived apart from me, that is without an intelligent substance in
which they reside, for [in the notion we have of these faculties, or, to use the language of the Schools] in their formal concept, some kind of intellection is comprised, from which I infer that they are distinct from me as its modes are from a thing. I observe also in me some other faculties such as that of change of position, the assumption of different figures and such like, which cannot be conceived, any more than can the preceding, apart from some substance to which they are attached, and consequently cannot exist without it; but it is very clear that these faculties, if it be true that they exist, must be attached to some corporeal or extended substance, and not to an intelligent substance, since in the clear and distinct conception of these there is some sort of extension found to be present, but no intellection at all. There is certainly further in me a certain passive faculty of perception, that is, of receiving and recognising the ideas of sensible things, but this would be useless to me [and I could in no way avail myself of it], if there were not either in me or in some other thing another active faculty capable of forming and producing these ideas. But this active faculty cannot exist in me [inasmuch as I am a thing that thinks] seeing that it does not presuppose thought, and also that those ideas are often produced in me without my contributing in any way to the same, and often even against my will; it is thus necessarily the case that the faculty resides in some substance different from me in which all the reality which is objectively in the ideas that are produced by this faculty is formally or eminently contained, as I remarked before. And this substance is either a body, that is, a corporeal nature in which there is contained formally [and really] all that which is objectively [and by representation] in those ideas, or it is God Himself, or some other creature more noble than body in which that same is contained eminently. But, since God is no deceiver, it is very manifest that He does not communicate to me these ideas immediately and by Himself, nor yet by the intervention of some creature in which their reality is not formally, but only eminently, contained. For since He has given me no faculty to recognise that this is the case, but, on the other hand, a very great inclination to believe [that they are sent to me or] that they are conveyed to me by corporeal objects, I do not see how He could be defended from
the accusation of deceit if these ideas were produced by causes other than corporeal objects. Hence we must allow that corporeal things exist. However, they are perhaps not exactly what we perceive by the senses, since this comprehension by the senses is in many instances very obscure and confused; but we must at least admit that all things which I conceive in them clearly and distinctly, that is to say, all things which, speaking generally, are comprehended in the object of pure mathematics, are truly to be recognised as external objects.

As to other things, however, which are either particular only, as, for example, that the sun is of such and such a figure, etc., or which are less clearly and distinctly conceived, such as light, sound, pain and the like, it is certain that although they are very dubious and uncertain, yet on the sole ground that God is not a deceiver, and that consequently He has not permitted any falsity to exist in my opinion which He has not likewise given me the faculty of correcting, I may assuredly hope to conclude that I have within me the means of arriving at the truth even here. And first of all there is no doubt that in all things which nature teaches me there is some truth contained; for by nature, considered in general, I now understand no other thing than either God Himself or else the order and disposition which God has established in created things; and by my nature in particular I understand no other thing than the complexus of all the things which God has given me.

But there is nothing which this nature teaches me more expressly [nor more sensibly] than that I have a body which is adversely affected when I feel pain, which has need of food or drink when I experience the feelings of hunger and thirst, and so on; nor can I doubt there being some truth in all this.

Nature also teaches me by these sensations of pain, hunger, thirst, etc., that I am not only lodged in my body as a pilot in a vessel, but that I am not only lodged in my body as a pilot in a vessel, but that I am very closely united to it, and so to speak so intermingled with it that I seem to compose with it one whole. For if that were not the case, when my body is hurt, I, who am merely a thinking thing, should not feel pain, for I should perceive this wound by the understanding only, just as the sailor perceives by sight when something is damaged in his
vessel; and when my body has need of drink or food, I should clearly understand the fact without being warned of it by confused feelings of hunger and thirst. For all these sensations of hunger, thirst, pain, etc. are in truth none other than certain confused modes of thought which are produced by the union and apparent intermingling of mind and body.

Moreover, nature teaches me that many other bodies exist around mine, of which some are to be avoided, and others sought after. And certainly from the fact that I am sensible of different sorts of colours, sounds, scents, tastes, heat, hardness, etc., I very easily conclude that there are in the bodies from which all these diverse sense-perceptions proceed certain variations which answer to them, although possibly these are not really at all similar to them. And also from the fact that amongst these different sense-perceptions some are very agreeable to me and others disagreeable, it is quite certain that my body (or rather myself in my entirety, inasmuch as I am formed of body and soul) may receive different impressions agreeable and disagreeable from the other bodies which surround it.

But there are many other things which nature seems to have taught me, but which at the same time I have never really received from her, but which have been brought about in my mind by a certain habit which I have of forming inconsiderate judgments on things; and thus it may easily happen that these judgments contain some error. Take, for example, the opinion which I hold that all space in which there is nothing that affects [or makes an impression on] my senses is void; that in a body which is warm there is something entirely similar to the idea of heat which is in me; that in a white or green body there is the same whiteness or greenness that I perceive; that in a bitter or sweet body there is the same taste, and so on in other instances; that the stars, the towers, and all other distant bodies are of the same figure and size as they appear from far off to our eyes, etc. But in order that in this there should be nothing which I do not conceive distinctly, I should define exactly what I really understand when I say that I am taught somewhat by nature. For here I take nature in a more limited signification than when I term it the sum of all the things given me by God, since in this sum many things are comprehended which only
pertain to mind (and to these I do not refer in speaking of nature) such as the notion which I have of the fact that what has once been done cannot ever be undone and an infinitude of such things which I know by the light of nature [without the help of the body]; and seeing that it comprehends many other matters besides which only pertain to body, and are no longer here contained under the name of nature, such as the quality of weight which it possesses and the like, with which I also do not deal; for in talking of nature I only treat of those things given by God to me as a being composed of mind and body. But the nature here described truly teaches me to flee from things which cause the sensation of pain, and seek after the things which communicate to me the sentiment of pleasure and so forth; but I do not see that beyond this it teaches me that from those diverse sense-perceptions we should ever form any conclusion regarding things outside of us, without having [carefully and maturely] mentally examined them beforehand. For it seems to me that it is mind alone, and not mind and body in conjunction, that is requisite to a knowledge of the truth in regard to such things. Thus, although a star makes no larger an impression on my eye than the flame of a little candle there is yet in me no real or positive propensity impelling me to believe that it is not greater than that flame; but I have judged it to be so from my earliest years, without any rational foundation. And although in approaching fire I feel heat, and in approaching it a little too near I even feel pain, there is at the same time no reason in this which could persuade me that there is in the fire something resembling this heat any more than there is in it something resembling the pain; all that I have any reason to believe from this is, that there is something in it, whatever it may be, which excites in me these sensations of heat or of pain. So also, although there are spaces in which I find nothing which excites my senses, I must not from that conclude that these spaces contain no body; for I see in this, as in other similar things, that I have been in the habit of perverting the order of nature, because these perceptions of sense having been placed within me by nature merely for the purpose of signifying to my mind what things are beneficial or hurtful to the composite whole of which it forms a part, and being up to that point sufficiently clear and distinct, I yet avail myself of them as though
they were absolute rules by which I might immediately determine the essence of the bodies which are outside me, as to which, in fact, they can teach me nothing but what is most obscure and confused.

But I have already sufficiently considered how, notwithstanding the supreme goodness of God, falsity enters into the judgments I make. Only here a new difficulty is presented one respecting those things the pursuit or avoidance of which is taught me by nature, and also respecting the internal sensations which I possess, and in which I seem to have sometimes detected error [and thus to be directly deceived by my own nature]. To take an example, the agreeable taste of some food in which poison has been intermingled may induce me to partake of the poison, and thus deceive me. It is true, at the same time, that in this case nature may be excused, for it only induces me to desire food in which I find a pleasant taste, and not to desire the poison which is unknown to it; and thus I can infer nothing from this fact, except that my nature is not omniscient, at which there is certainly no reason to be astonished, since man, being finite in nature, can only have knowledge the perfectness of which is limited.

But we not unfrequently deceive ourselves even in those things to which we are directly impelled by nature, as happens with those who when they are sick desire to drink or eat things hurtful to them. It will perhaps be said here that the cause of their deceptiveness is that their nature is corrupt, but that does not remove the difficulty, because a sick man is none the less truly God’s creature than he who is in health; and it is therefore as repugnant to God’s goodness for the one to have a deceitful nature as it is for the other. And as a clock composed of wheels and counter-weights no less exactly observes the laws of nature when it is badly made, and does not show the time properly, than when it entirely satisfies the wishes of its maker, and as, if I consider the body of a man as being a sort of machine so built up and composed of nerves, muscles, veins, blood and skin, that though there were no mind in it at all, it would not cease to have the same motions as at present, exception being made of those movements which are due to the direction of the will, and in consequence depend upon the mind [as apposed to those which operate by the disposition of its organs], I easily recognise that it would be as natural to this body,
supposing it to be, for example, dropsical, to suffer the parchedness
of the throat which usually signifies to the mind the feeling of thirst,
and to be disposed by this parched feeling to move the nerves and
other parts in the way requisite for drinking, and thus to augment its
malady and do harm to itself, as it is natural to it, when it has no indis-
position, to be impelled to drink for its good by a similar cause. And
although, considering the use to which the clock has been destined by
its maker, I may say that it deflects from the order of its nature when it
does not indicate the hours correctly; and as, in the same way, consid-
ering the machine of the human body as having been formed by God
in order to have in itself all the movements usually manifested there,
I have reason for thinking that it does not follow the order of nature
when, if the throat is dry, drinking does harm to the conservation of
health, nevertheless I recognise at the same time that this last mode
of explaining nature is very different from the other. For this is but
a purely verbal characterisation depending entirely on my thought,
which compares a sick man and a badly constructed clock with the idea
which I have of a healthy man and a well made clock, and it is hence
extrinsic to the things to which it is applied; but according to the other
interpretation of the term nature I understand something which is
truly found in things and which is therefore not without some truth.

But certainly although in regard to the dropsical body it is only
so to speak to apply an extrinsic term when we say that its nature is
corrupted, inasmuch as apart from the need to drink, the throat is
parched; yet in regard to the composite whole, that is to say, to the mind
or soul united to this body, it is not a purely verbal predicate, but a real
error of nature, for it to have thirst when drinking would be hurtful to
it. And thus it still remains to inquire how the goodness of God does
not prevent the nature of man so regarded from being fallacious.

In order to begin this examination, then, I here say, in the first place,
that there is a great difference between mind and body, inasmuch as
body is by nature always divisible, and the mind is entirely indivisi-
ble. For, as a matter of fact, when I consider the mind, that is to say,
myself inasmuch as I am only a thinking thing, I cannot distinguish in
myself any parts, but apprehend myself to be clearly one and entire;
and although the whole mind seems to be united to the whole body,
yet if a foot, or an arm, or some other part, is separated from my body, I am aware that nothing has been taken away from my mind. And the faculties of willing, feeling, conceiving, etc. cannot be properly speaking said to be its parts, for it is one and the same mind which employs itself in willing and in feeling and understanding. But it is quite otherwise with corporeal or extended objects, for there is not one of these imaginable by me which my mind cannot easily divide into parts, and which consequently I do not recognise as being divisible; this would be sufficient to teach me that the mind or soul of man is entirely different from the body, if I had not already learned it from other sources.

I further notice that the mind does not receive the impressions from all parts of the body immediately, but only from the brain, or perhaps even from one of its smallest parts, to wit, from that in which the common sense is said to reside, which, whenever it is disposed in the same particular way, conveys the same thing to the mind, although meanwhile the other portions of the body may be differently disposed, as is testified by innumerable experiments which it is unnecessary here to recount.

I notice, also, that the nature of body is such that none of its parts can be moved by another part a little way off which cannot also be moved in the same way by each one of the parts which are between the two, although this more remote part does not act at all. As, for example, in the cord ABCD [which is in tension] if we pull the last part D, the first part A will not be moved in any way differently from what would be the case if one of the intervening parts B or C were pulled, and the last part D were to remain unmoved. And in the same way, when I feel pain in my foot, my knowledge of physics teaches me that this sensation is communicated by means of nerves dispersed through the foot, which, being extended like cords from there to the brain, when they are contracted in the foot, at the same time contract the inmost portions of the brain which is their extremity and place of origin, and then excite a certain movement which nature has established in order to cause the mind to be affected by a sensation of pain represented as existing in the foot. But because these nerves must pass through the tibia, the thigh, the loins, the back and the neck, in order to reach from the leg to the brain, it may happen that
although their extremities which are in the foot are not affected, but only certain ones of their intervening parts [which pass by the loins or the neck], this action will excite the same movement in the brain that might have been excited there by a hurt received in the foot, in consequence of which the mind will necessarily feel in the foot the same pain as if it had received a hurt. And the same holds good of all the other perceptions of our senses.

I notice finally that since each of the movements which are in the portion of the brain by which the mind is immediately affected brings about one particular sensation only, we cannot under the circumstances imagine anything more likely than that this movement, amongst all the sensations which it is capable of impressing on it, causes mind to be affected by that one which is best fitted and most generally useful for the conservation of the human body when it is in health. But experience makes us aware that all the feelings with which nature inspires us are such as I have just spoken of; and there is therefore nothing in them which does not give testimony to the power and goodness of the God [who has produced them]. Thus, for example, when the nerves which are in the feet are violently or more than usually moved, their movement, passing through the medulla of the spine to the inmost parts of the brain, gives a sign to the mind which makes it feel somewhat, to wit, pain, as though in the foot, by which the mind is excited to do its utmost to remove the cause of the evil as dangerous and hurtful to the foot. It is true that God could have constituted the nature of man in such a way that this same movement in the brain would have conveyed something quite different to the mind; for example, it might have produced consciousness of itself either in so far as it is in the brain, or as it is in the foot, or as it is in some other place between the foot and the brain, or it might finally have produced consciousness of anything else whatsoever; but none of all this would have contributed so well to the conservation of the body. Similarly, when we desire to drink, a certain dryness of the throat is produced which moves its nerves, and by their means the internal portions of the brain; and this movement causes in the mind the sensation of thirst, because in this case there is nothing more useful to us than to become aware that we have need
to drink for the conservation of our health; and the same holds good in other instances.

From this it is quite clear that, notwithstanding the supreme goodness of God, the nature of man, inasmuch as it is composed of mind and body, cannot be otherwise than sometimes a source of deception. For if there is any cause which excites, not in the foot but in some part of the nerves which are extended between the foot and the brain, or even in the brain itself, the same movement which usually is produced when the foot is detrimentally affected, pain will be experienced as though it were in the foot, and the sense will thus naturally be deceived; for since the same movement in the brain is capable of causing but one sensation in the mind, and this sensation is much more frequently excited by a cause which hurts the foot than by another existing in some other quarter, it is reasonable that it should convey to the mind pain in the foot rather than in any other part of the body. And although the parchedness of the throat does not always proceed, as it usually does, from the fact that drinking is necessary for the health of the body, but sometimes comes from quite a different cause, as is the case with dropsical patients, it is yet much better that it should mislead on this occasion than if, on the other hand, it were always to deceive us when the body is in good health; and so on in similar cases.

And certainly this consideration is of great service to me, not only in enabling me to recognise all the errors to which my nature is subject, but also in enabling me to avoid them or to correct them more easily. for knowing that all my senses more frequently indicate to me truth than falsehood respecting the things which concern that which is beneficial to the body, and being able almost always to avail myself of many of them in order to examine one particular thing, and, besides that, being able to make use of my memory in order to connect the present with the past, and of my understanding which already has discovered all the causes of my errors, I ought no longer to fear that falsity may be found in matters every day presented to me by my senses. And I ought to set aside all the doubts of these past days as hyperbolical and ridiculous, particularly that very common uncertainty respecting sleep, which I could not distinguish from the
waking state; for at present I find a very notable difference between the two, inasmuch as our memory can never connect our dreams one with the other, or with the whole course of our lives, as it unites events which happen to us while we are awake. And, as a matter of fact, if someone, while I was awake, quite suddenly appeared to me and disappeared as fast as do the images which I see in sleep, so that I could not know from whence the form came nor whither it went, it would not be without reason that I should deem it a spectre or a phantom formed by my brain [and similar to those which I form in sleep], rather than a real man. But when I perceive things as to which I know distinctly both the place from which they proceed, and that in which they are, and the time at which they appeared to me; and when, without any interruption, I can connect the perceptions which I have of them with the whole course of my life, I am perfectly assured that these perceptions occur while I am waking and not during sleep. And I ought in no wise to doubt the truth of such matters, if, after having called up all my senses, my memory, and my understanding, to examine them, nothing is brought to evidence by any one of them which is repugnant to what is set forth by the others. For because God is in no wise a deceiver, it follows that I am not deceived in this. But because the exigencies of action often oblige us to make up our minds before having leisure to examine matters carefully, we must confess that the life of man is very frequently subject to error in respect to individual objects, and we must in the end acknowledge the infirmity of our nature.
NEWTON’S LAWS OF MOTION

LAW I

Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon.

Projectiles preserve in their motions, so far as they are not retarded by the resistance of the air, or impelled downwards by the force of gravity. A spinning top, whose parts by their cohesion are perpetually drawn aside from rectilinear motions, does not cease its rotation, unless it is retarded by the air. The greater bodies of the planets and comets, meeting with less resistance in more free spaces, preserve their motions both progressive and circular for a much longer time.

LAW II

The alteration of motion is ever proportional to the motive force impressed and is made in the direction of the right line in which that force is impressed.

If any force generates a motion, doubling that force will double the motion, and tripling that force will generate triple the motion, whether that force is impressed all together and at once, or gradually and successively by degrees. And this motion (being always directed the same way with the generating force) if the body moved before, is added to or subtracted from the former motion, according to whether
they were directly conspired with or are directly contrary to each other; or obliquely joined, when they are oblique, so as to produce a new motion compounded from the determination of both.

**LAW III**

*To every action there is always an opposite
and equal reaction, that is, the mutual actions
of two bodies upon each other are always
equal, and directed to contrary parts.*

Whatever draws or presses another is as much drawn or pressed by that other. If you press a stone with your finger, the finger is also pressed by the stone. If a horse draws a boulder tied to a rope, the horse (so to speak) will be equally drawn back towards the boulder, for the extended rope, by the same endeavor to relax or unbend itself, will draw the horse as much towards the boulder as it does the boulder towards the horse, and will obstruct the progress of the one as much as it advances that of the other. If a body impinge upon another, and by its force change the motion of the other, that body also (because of the equality of the mutual pressure), will undergo an equal change in its own motion towards the contrary part. The changes made by these actions are equal, not in velocities, but in the motions of bodies, that is to say, if the bodies are not hindered by any other impediments. For since the motions are equally changed, the changes of the velocities made towards contrary parts are reciprocally proportional to the bodies. This law takes place also in attractions, as will be proved in the next Scholium.
PROPOSITION VII. THEOREM VII.

*Gravity exists in all bodies universally and is proportional to the quantity of matter they contain.*

That all the planets mutually gravitate one towards the other we have proved before, as well as that the force of gravity towards every one of them, considered separately, is reciprocally as the square of the distance of places from the center of the planet. And so (by Prop. LXIX, Book I, and its Corollaries) it follows, that the gravity tending towards all the planets is proportional to the matter which they contain.

Furthermore, since all the parts of any planet A gravitate towards any other planet B, and the gravity of every part is to the gravity of the whole as the matter of the part to the matter of the whole, and (by Law III) to every action corresponds an equal reaction, therefore the planet B will, on the other hand, gravitate towards all the parts of the planet A, and its gravity towards any one part will be to the gravity towards the whole as the matter of the part to the matter of the whole. Q.E.D.

Corollary 1. Therefore, the force of gravity towards any whole planet arises from, and is compounded of, the forces of gravity towards all its parts. Magnetic and electric attractions afford us examples of this, for all attraction towards the whole arises from the attractions towards the several parts. The thing may be easily understood in gravity, if we consider a greater planet, as formed of a number of lesser planets, meeting together in one globe, *for it would therefore appear that* the force of the whole must arise from the forces of the component
parts. If it is objected that according to this law, all bodies with us must mutually gravitate one towards another, even though our senses cannot perceive this gravity, I answer that since the gravitation towards these bodies is to the gravitation towards the whole earth as these bodies are to the whole earth, the gravitation towards them must be far less than to fall under the observation of our senses.

Corollary 2. The force of gravity towards the several equal particles of any body is reciprocally as the square of the distance of places from the particles, as appears from Cor. 3, Prop. LXXXIV, Book I.
The Hypothesis of Vortices is pressed with many Difficulties. That each Planet, with a Radius drawn to the Sun, may describe Areas proportional to the Time, the Periodical Times of the parts of the Vortex ought to be in a Duplicate Proportion of their Distances from the Sun. That the Periodical Times of the Planets may be in a Sesquiplicate Proportion\(^1\) of their Distances from the Sun, the Periodical Times of the parts of the Vortex ought to be in the same Proportion of the Distances. That the lesser Vortices, which roll round Jupiter, Saturn, and the other Planets, may be preserved, and Swim undisturbed in the Vortex of the Sun, the Periodical Times of the parts of the Solar Vortex should be equal. The Revolutions of the Sun and Planets upon their Axes differ from all these Proportions. The Motions of the Comets are exactly Regular, and observe the same Laws with the Motions of the Planets, and cannot be explained by Vortices.

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\(^1\) 3/2 powers.
The Comets are carried by Motions very Eccentrical toward all parts of the Heaven, which upon the supposition of Vortices is impossible. Projected Bodies in our Air, meet with no resistance but that of the Air. The Air being taken away, as it is in Mr. Boyles Air-Pump, the resistance ceases, seeing soft Down and solid Gold fall in such a Vacuum with equal Velocity; and the Case is the same in those Celestial Spaces above the Earth’s Atmosphere. All Bodies ought to be moved most freely in those Spaces, and therefore the Planets and Comets ought perpetually to be resolved according to the Laws already Explained, in Orbs such in kind and position, as we have supposed. They will indeed be retained in their Orbits by the Laws of Gravity, but they could be no means at first acquire such a regular position of their Orbs by those Laws.

The Six Primary Planets revolve round the Sun in Circles Concentrical to the Sun, with the same direction of their Motion, and very nearly in the same plain. The Ten Moons (or Secondary Planets) Revolve round the Earth, Jupiter and Saturn, with the same Direction of their Motion, and very nearly in the plain of the Orbs of the Planets. And all these regular Motions have not their rise from Mechanical Causes, seeing the Comets are carried in Orbs very Eccentrical, and that very freely through all parts of the Heaven. By which kind of Motion the Comets pass very swiftly and easily thro’ the Orbs of the Planets, and in their Aphelia when they move more slowly, and are longer detained they are the most remotely distant from one another, and their mutual attraction by much the weakest. This most Elegant System of the Planets and Comets could not be produced but by and under the Contrivance and Dominion of an Intelligent and Powerful Being. And if the Fixed Stars are the Centers of such other Systems, all these being Framed by the like Council will be Subject to the Dominion of One, especially seeing the Light of the Fixed Stars is of the same Nature with that of the Sun, and the Light of all these Systems passes mutually from one to another. He governs all things, not as the Soul of the World, but as the Lord of the Universe, and because of his Dominion, he is wont to be called Lord God pantokrator (i.e. Universal Ruler or Emperor) for God is a Relative Word, and hath a Relation to Servants: And the Deity is the Empire of God, not over his own Body
(as is the Opinion of those, who make him the Soul of the World) but over his Servants. The Supreme God is a Being Eternal, Infinite, Absolutely Perfect; but a Being however Perfect, without Dominion, is not Lord God: For we say, my God, your God, the God of Israel, but we do not say, my Eternal, your Eternal, the Eternal of Israel; we do not say, my Infinite, your Infinite, the Infinite of Israel; we do not say, my Perfect, your Perfect, the Perfect of Israel. These Titles have no Relation to Servants. The word God frequently signifies Lord, but every Lord is not God. The Empire of a Spiritual being constitutes God, true Empire constitutes True God, Supreme the Supreme, Feigned the Feigned. And from his true Empire it follows that the true God is Living, Intelligent and Powerful, from his other Perfections, that he is the Supreme or Supremely Perfect. He is Eternal and Infinite, Omnipotent and Omnipresent, that is, he endures from Eternity to Eternity, and he is present from Infinity to Infinity, he Governs all Things, and Knows all Things which are or which can be known. He is not Eternity or Infinity, but he is Eternal and Infinite, he is not Duration or Space, but he Endures and is Present. He endures always and is present every where, and by existing always and every where, he Constitutes Duration and Space, Eternity and Infinity. Whereas every Particle of Space is always, and every Individual Moment of Duration is every where, certainly the Framer and Lord of the Universe shall not be (nunquam nusquam) never no where. He is Omnipresent not Virtually only, but also Substantially, for Power without Substance cannot Subsist. In him are contained and moved all things (so the Ancients thought. Aratus Phænomen. at the beginning. Paul Acts 17. 27, 28. Moses Deut. 4. 39. and 10. 14. David Psalm 139. 7, 8. Solomon Kings 8. 27. Job 22. 12. Jeremiah 23. 23, 24.) but without mutual Passion. God suffers nothing from the Motions of Bodies: Nor do they suffer any Resistance from the Omnipresence of God. It is confessed that the Supreme God exists Necessarily, and by the same Necessity he is always and every where. Whence also he is wholly Similar, all Eye, all Ear, all Brain, all Arm, all the Power of Perceiving, Understanding and Acting; but after a manner not at all Corporeal, after a manner not like that of Men, after a manner wholly to us unknown. As a Blind Man has no Notion of Colors, so neither have we any Notion of the manner how the most
wise God perceives and understands all things. He is wholly destitute of all Body and Bodily Shape, and therefore cannot be seen, heard, not touched; nor ought to be Worshipped under the Representation of any thing Corporeal. We have Ideas of his Attributes, but we know not at all what is the Substance of any thing whatever. We see only the Figures and Colors of Bodies, we hear only Sounds, we touch only the outward Surfaces, we smell only Odors and taste Tastes; but we know not by any sense or reflex Act the inward Substances; and much less have we any Notion of the Substance of God: We known him only by his Properties and Attributes, and by the most Wise and Excellent Structure of things, and by Final Causes; but we Adore and Worship him upon account of his Dominion. For God, without Dominion, Providence and Final Causes, is nothing else than Fate and Nature. And so much of God, of whom to discourse from Phenomena belongs to Experimental Philosophy.

Hitherto I have explained the Phenomena of the Heavens and of our Sea by the Power of Gravity, but I have not at all assigned the Causes of Gravity. This Power however arises from some Cause, which penetrates even to the Center of the Sun and Planets, without any diminution of its force, and which acts not in proportion to the quantity of the Surfaces of the Particles upon which it acts (as Mechanical Causes use to do) but according to the quantity of solid Matter; and whose Action is every way extended to Immense Distances, decreasing always in a Duplicate Proportion of those Distances. Gravity towards the Sun is composed of the Gravities towards each Particle of the Sun, and decreases from the Sun-ward accurately in a Duplicate Proportion of those Distances as far as the Orb of Saturn, as is evidence from the rest of the Aphelia of the Planets, and as far as the remotest Aphelia of the Comets, if their Aphelia also rest. But I have not yet been able to Deduce the Reason of these Properties of Gravity from Phenomena, and I do not Form Hypotheses, for whatever is not Deduced from Appearances is to be Termed an Hypothesis, and Hypotheses whether Metaphysical, or Physical, or of Occult Qualities, or Mechanical, have no Place in Experimental Philosophy. In this Philosophy Propositions are Deduced from Appearances, and rendered General by Induction. So the Impenetrability, Mobility, and the Force of Bodies, and the
Laws of Motion and of Gravity have been known. And it is enough that Gravity really exists, and acts according to the Laws explained by us, and suffices for all the Motions of the Heavenly Bodies, and of our Sea. I might now add something concerning a certain most subtle Spirit penetrating gross Bodies and lying hid in them, by whose Force and Action the Particles of Bodies attract one another mutually at the least distance, and cohere upon contact, and Electrical Bodies act at greater Distances, as well by Repelling as Attracting Neighboring Bodies, and Light is Emitted, Reflected, Refracted and Inflected, and warms Bodies, and all Sensation is Excited, and the Members of Animals are moved according to the Will, viz. by the Vibration of this Spirit propagated along the solid Capillaments of the Nerves, from the External Organs of Sense to the Brain, and from the Brain to the Muscles. But these cannot be explained in a few words, neither have we a sufficient Number of Experiments, by which the Laws of the Actions of this Spirit ought to be accurately determined and demonstrated.
And for rejecting such a Medium, we have the Authority of those the oldest and most celebrated Philosophers of Greece and Phoenicia, who made a Vacuum and Atoms, and the Gravity of Atoms, the first Principles of their Philosophy; tacitly attributing Gravity to some other Cause than dense Matter. Later Philosophers banish the Consideration of such a Cause out of natural Philosophy, feigning Hypotheses for explaining all things mechanically, and referring other Causes to Metaphysics: Whereas the main Business of natural Philosophy is to argue from Phenomena without feigning Hypotheses, and to deduce Causes from Effects, till we come to the very first Cause, which certainly is not mechanical; and not only to unfold the Mechanism of the World, but chiefly to resolve these and such like Questions. What is there in places almost empty of Matter, and whence is it that the Sun and Planets gravitate towards one another, without dense Matter between them? Whence is it that Nature doth nothing in vain; and whence arises all that Order and Beauty which we see in the
World? To what end are Comets, and whence is it that Planets move all one and the same way in Orbs concentric, while Comets move all manner of ways in Orbs very excentric; and what hinders the fixed Stars from falling upon one another? How came the Bodies of Animals to be contrived with so much Art, and for what ends were their several Parts? Was the Eye contrived without Skill in Optics, and the Ear without Knowledge of Sounds? How do the Motions of the Body follow from the Will, and whence is the Instinct in Animals? Is not the Sensory of Animals that place to which the sensitive Substance is present, and into which the sensible Species of Things are carried through the Nerves and Brain, that there they may be perceived by their immediate presence to that Substance? And these things being rightly dispatched, does it not appear from Phenomena that there is a Being incorporeal, living, intelligent, omnipresent, who in infinite Space, as it were in his Sensory, sees the things themselves intimately, and thoroughly perceives them, and comprehends them wholly by their immediate presence to himself: Of which things the Images only carried through the Organs of Sense into our little Sensoriums, are there seen and beheld by that which in us perceives and thinks. And though every true Step made in this Philosophy brings us not immediately to the Knowledge of the first Cause, yet it brings us nearer to it, and on that account is to be highly valued.

**QUERY 31 (SELECTION)**

And thus Nature will be very conformable to herself and very simple, performing all the great Motions of the heavenly Bodies by the Attraction of Gravity which intercedes those Bodies, and almost all the small ones of their Particles by some other attractive and repelling Powers which intercede the Particles. The *Vis inertiæ* is a passive Principle by which Bodies persist in their Motion or Rest, receive Motion in proportion to the Force impressing it, and resist as much as they are resisted. By this Principle alone there never could have been any Motion in the World. Some other Principle was necessary for putting Bodies into Motion; and now they are in Motion, some other Principle is necessary for conserving the Motion. For from the
various Composition of two Motions, 'tis very certain that there is not always the same quantity of Motion in the World. For if two Globes joined by a slender Rod, revolve about their common Center of Gravity with an uniform Motion, while that Center moves on uniformly in a right Line drawn in the Plane of their circular Motion; the Sum of the Motions of the two Globes, as often as the Globes are in the right Line described by their common Center of Gravity, will be bigger than the Sum of their Motions, when they are in a Line perpendicular to that right Line. By this Instance it appears that Motion may be got or lost. But by reason of the Tenacity of Fluids, and Attrition of their Parts, and the Weakness of Elasticity in Solids, Motion is much more apt to be lost than got, and is always upon the Decay. For Bodies which are either absolutely hard, or so soft as to be void of Elasticity, will not rebound from one another. Impenetrability makes them only stop. If two equal Bodies meet directly in vacuo\(^1\), they will by the Laws of Motion stop where they meet, and lose all their Motion, and remain in rest, unless they be elastic, and receive new Motion from their Spring. If they have so much Elasticity as suffices to make them re-bound with a quarter, or half, or three quarters of the Force with which they come together, they will lose three quarters, or half, or a quarter of their Motion. And this may be tried, by letting two equal Pendulums fall against one another from equal heights. If the Pendulums be of Lead or soft Clay, they will lose all or almost all their Motions: If of elastic Bodies they will lose all but what they recover from their Elasticity. If it be said, that they can lose no Motion but what they communicate to other Bodies, the consequence is, that in vacuo they can lose no Motion, but when they meet they must go on and penetrate one another’s Dimensions. If three equal round Vessels be filled, the one with Water, the other with Oil, the third with molten Pitch, and the Liquors be stirred about alike to give them a vortical Motion; the Pitch by its Tenacity will lose its Motion quickly, the Oil being less tenacious will keep it longer, and the Water being less tenacious will keep it longest, but yet will lose it in a short time. Whence it is easy to understand, that

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\(^1\) In a vacuum.
if many contiguous Vortices of molten Pitch were each of them as large as those which some suppose to revolve about the Sun and fixed Stars, yet these and all their Parts would, by their Tenacity and Stiffness, communicate their Motion to one another till they all rested among themselves. Vortices of Oil or Water, or some fluider Matter, might continue longer in Motion; but unless the Matter were void of all Tenacity and Attrition of Parts, and Communication of Motion, (which is not to be supposed,) the Motion would constantly decay. Seeing therefore the variety of Motion which we find in the World is always decreasing, there is a necessity of conserving and recruiting it by active Principles, such as are the cause of Gravity, by which Planets and Comets keep their Motions in their Orbs, and Bodies acquire great Motion in falling; and the cause of Fermentation, by which the Heart and Blood of Animals are kept in perpetual Motion and Heat; the inward Parts of the Earth are constantly warmed, and in some places grow very hot; Bodies burn and shine, Mountains take fire, the Caverns of the Earth are blown up, and the Sun continues violently hot and lucid, and warms all things by his Light. For we meet with very little Motion in the World, besides what is owing to these active Principles. And if it were not for these Principles, the Bodies of the Earth, Planets, Comets, Sun, and all things in them, would grow cold and freeze, and become inactive Masses; and all Putrefaction, Generation, Vegetation and Life would cease, and the Planets and Comets would not remain in their Orbs. All these things being considered, it seems probable to me, that God in the Beginning formed Matter in solid, massy, hard, impenetrable, moveable Particles, of such Sizes and Figures, and with such other Properties, and in such Proportion to Space, as most conduced to the End for which he formed them; and that these primitive Particles being Solids, are incomparably harder than any porous Bodies compounded of them; even so very hard, as never to wear or break in pieces; no ordinary Power being able to divide what God himself made one in the first Creation. While the Particles continue entire, they may compose Bodies of one and the same Nature and Texture in all Ages: But should they wear away, or break in pieces, the Nature of Things depending on them, would be changed. Water and Earth,
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composed of old worn Particles and Fragments of Particles, would not be of the same Nature and Texture now, with Water and Earth composed of entire Particles in the Beginning. And therefore, that Nature may be lasting, the Changes of corporeal Things are to be placed only in the various Separations and new Associations and Motions of these permanent Particles; compound Bodies being apt to break, not in the midst of solid Particles, but where those Particles are laid together, and only touch in a few Points. It seems to me farther, that these Particles have not only a Vis inertiae, accompanied with such passive Laws of Motion as naturally result from that Force, but also that they are moved by certain active Principles, such as is that of Gravity, and that which causes Fermentation, and the Cohesion of Bodies. These Principles I consider, not as occult Qualities, supposed to result from the specific Forms of Things, but as general Laws of Nature, by which the Things themselves are formed; their Truth appearing to us by Phenomena, though their Causes be not yet discovered. For these are manifest Qualities, and their Causes only are occult. And the Aristotelians gave the Name of occult Qualities, not to manifest Qualities, but to such Qualities only as they supposed to lie hid in Bodies, and to be the unknown Causes of manifest Effects: Such as would be the Causes of Gravity, and of magnetic and electric Attractions, and of Fermentations, if we should suppose that these Forces or Actions arose from Qualities unknown to us, and uncapable of being discovered and made manifest. Such occult Qualities put a stop to the Improvement of natural Philosophy, and therefore of late Years have been rejected. To tell us that every Species of Things is endowed with an occult specific Quality by which it acts and produces manifest Effects, is to tell us nothing: But to derive two or three general Principles of Motion from Phenomena, and afterwards to tell us how the Properties and Actions of all corporeal Things follow from those manifest Principles, would be a very great step in Philosophy, though the Causes of those Principles were not yet discovered: And therefore I scruple not to propose the Principles of Motion above-mentioned, they being of very general Extent,

2 Inertia. The tendency of a property to continue in its state unless acted upon.
and leave their Causes to be found out. Now by the help of these Principles, all material Things seem to have been composed of the hard and solid Particles above-mentioned, variously associated in the first Creation by the Counsel of an intelligent Agent. For it became him who created them to set them in order. And if he did so, it’s unphilosophical to seek for any other Origin of the World, or to pretend that it might arise out of a Chaos by the mere Laws of Nature; though being once formed, it may continue by those Laws for many Ages. For while Comets move in very excentric Orbs in all manner of Positions, blind Fate could never make all the Planets move one and the same way in Orbs concentric, some inconsiderable Irregularities excepted, which may have risen from the mutual Actions of Comets and Planets upon one another, and which will be apt to increase, till this System wants a Reformation. Such a wonderful Uniformity in the Planetary System must be allowed the Effect of Choice. And so must the Uniformity in the Bodies of Animals, they having generally a right and a left side shaped alike, and on either side of their Bodies two Legs behind, and either two Arms, or two Legs, or two Wings before upon their Shoulders, and between their Shoulders a Neck running down into a Back-bone, and a Head upon it; and in the Head two Ears, two Eyes, a Nose, a Mouth, and a Tongue, alike situated. Also the first Contrivance of those very artificial Parts of Animals, the Eyes, Ears, Brain, Muscles, Heart, Lungs, Midriff, Glands, Larynx, Hands, Wings, swimming Bladders, natural Spectacles, and other Organs of Sense and Motion; and the Instinct of Brutes and Insects, can be the effect of nothing else than the Wisdom and Skill of a powerful ever-living Agent, who being in all Places, is more able by his Will to move the Bodies within his boundless uniform Sensorium, and thereby to form and reform the Parts of the Universe, than we are by our Will to move the Parts of our own Bodies. And yet we are not to consider the World as the Body of God, or the several Parts thereof, as the Parts of God. He is an uniform Being, void of Organs, Members or Parts, and they are his Creatures subordinate to him, and subservient to his Will; and he is no more the Soul of them, than the Soul of Man is the Soul of the Species of Things carried through the Organs of Sense into the place of its
Sensation, where it perceives them by means of its immediate Presence, without the Intervention of any third thing. The Organs of Sense are not for enabling the Soul to perceive the Species of Things in its Sensorium, but only for conveying them thither; and God has no need of such Organs, he being every where present to the Things themselves. And since Space is divisible *in infinitum*, and Matter is not necessarily in all places, it may be also allowed that God is able to create Particles of Matter of several Sizes and Figures, and in several Proportions to Space, and perhaps of different Densities and Forces, and thereby to vary the Laws of Nature, and make Worlds of several sorts in several Parts of the Universe. At least, I see nothing of Contradiction in all this. 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 Experiments, or other certain Truths. For Hypotheses are not to be regarded in experimental Philosophy. And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of, and may be looked upon as so much the stronger, by how much the Induction is more general. And if no Exception occur from Phenomena, the Conclusion may be pronounced generally. But if at any time afterwards any Exception shall occur from Experiments, it may then begin to be pronounced with such Exceptions as occur. By this way of Analysis we may proceed from Compounds to Ingredients, and from Motions to the Forces producing them; and in general, from Effects to their Causes, and from particular Causes to more general ones, till the Argument end in the most general. This is the Method of Analysis: And the Synthesis consists in assuming the Causes discovered, and established as Principles, and by them explaining the Phenomena proceeding from them, and proving the Explanations. In the two first Books of these Optics, I proceeded by this Analysis to discover and prove the original Differences of the Rays of Light in respect of Refrangibility,
Reflexibility, and Color, and their alternate Fits of easy Reflection and easy Transmission, and the Properties of Bodies, both opaque and pellucid\(^3\), on which their Reflections and Colors depend. And these Discoveries being proved, may be assumed in the Method of Composition for explaining the Phenomena arising from them: An Instance of which Method I gave in the End of the first Book. In this third Book I have only begun the Analysis of what remains to be discovered about Light and its Effects upon the Frame of Nature, hinting several things about it, and leaving the Hints to be examined and improved by the farther Experiments and Observations of such as are inquisitive. And if natural Philosophy in all its Parts, by pursuing this Method, shall at length be perfected, the Bounds of Moral Philosophy will be also enlarged. For so far as we can know by natural Philosophy what is the first Cause, what Power he has over us, and what Benefits we receive from him, so far our Duty towards him, as well as that towards one another, will appear to us by the Light of Nature. And no doubt, if the Worship of false Gods had not blinded the Heathen, their moral Philosophy would have gone farther than to the four Cardinal Virtues; and instead of teaching the Transmigration of Souls, and to worship the Sun and Moon, and dead Heroes, they would have taught us to worship our true Author and Benefactor, as their Ancestors did under the Government of *Noah* and his Sons before they corrupted themselves.

\(^3\) Translucently clear.
AN ENQUIRY CONCERNING
HUMAN UNDERSTANDING

SELECTIONS

David Hume
SECTION IV.

Sceptical Doubts

concerning the Operations
of the Understanding.
PART I.

All the objects of human reason or enquiry may naturally be divided into two kinds, to wit, Relations of Ideas, and Matters of Fact. Of the first kind are the sciences of Geometry, Algebra, and Arithmetic; and in short, every affirmation, which is either intuitively or demonstratively certain. That the square of the hypothenuse is equal to the square of the two sides, is a proposition, which expresses a relation between these figures. That three times five is equal to the half of thirty, expresses a relation between these numbers. Propositions of this kind are discoverable by the mere operation of thought, without dependence on what is anywhere existent in the universe. Though there never were a circle or triangle in nature, the truths, demonstrated by Euclid, would for ever retain their certainty and evidence.

Matters of fact, which are the second objects of human reason, are not ascertained in the same manner; nor is our evidence of their truth, however great, of a like nature with the foregoing. The contrary of every matter of fact is still possible; because it can never imply a contradiction, and is conceived by the mind with the same facility and distinctness, as if ever so conformable to reality. That the sun will not rise to-morrow is no less intelligible a proposition, and implies no more contradiction, than the affirmation, that it will rise. We should in vain, therefore, attempt to demonstrate its falsehood. Were it demonstratively false, it would imply a contradiction, and could never be distinctly conceived by the mind.

It may, therefore, be a subject worthy of curiosity, to enquire what is the nature of that evidence, which assures us of any real existence
AN ENQUIRY CONCERNING HUMAN UNDERSTANDING

and matter of fact, beyond the present testimony of our senses, or the records of our memory. This part of philosophy, it is observable, has been little cultivated, either by the ancients or moderns; and therefore our doubts and errors, in the prosecution of so important an enquiry, may be the more excusable; while we march through such difficult paths, without any guide or direction. They may even prove useful, by exciting curiosity, and destroying that implicit faith and security, which is the bane of all reasoning and free enquiry. The discovery of defects in the common philosophy, if any such there be, will not, I presume, be a discouragement, but rather an incitement, as is usual, to attempt something more full and satisfactory, than has yet been proposed to the public.

All reasonings concerning matter of fact seem to be founded on the relation of Cause and Effect. By means of that relation alone we can go beyond the evidence of our memory and senses. If you were to ask a man, why he believes any matter of fact, which is absent; for instance, that his friend is in the country, or in France; he would give you a reason; and this reason would be some other fact; as a letter received from him, or the knowledge of his former resolutions and promises. A man, finding a watch or any other machine in a desert island, would conclude, that there had once been men in that island. All our reasonings concerning fact are of the same nature. And here it is constantly supposed, that there is a connection between the present fact and that which is inferred from it. Were there nothing to bind them together, the inference would be entirely precarious. The hearing of an articulate voice and rational discourse in the dark assures us of the presence of some person: Why? because these are the effects of the human make and fabric, and closely connected with it. If we anatomize all the other reasonings of this nature, we shall find, that they are founded on the relation of cause and effect, and that this relation is either near or remote, direct or collateral. Heat and light are collateral effects of fire, and the one effect may justly be inferred from the other.

If we would satisfy ourselves, therefore, concerning the nature of that evidence, which assures us of matters of fact, we must enquire how we arrive at the knowledge of cause and effect.
I shall venture to affirm, as a general proposition, which admits of no exception, that the knowledge of this relation is not, in any instance, attained by reasonings à priori; but arises entirely from experience, when we find, that any particular objects are constantly conjoined with each other. Let an object be presented to a man of ever so strong natural reason and abilities; if that object be entirely new to him, he will not be able, by the most accurate examination of its sensible qualities, to discover any of its causes or effects. Adam, though his rational faculties be supposed, at the very first, entirely perfect, could not have inferred from the fluidity, and transparency of water, that it would suffocate him, or from the light and warmth of fire, that it would consume him. No object ever discovers, by the qualities which appear to the senses, either the causes which produced it, or the effects which will arise from it; nor can our reason, unassisted by experience, ever draw any inference concerning real existence and matter of fact.

This proposition, that causes and effects are discoverable, not by reason, but by experience, will readily be admitted with regard to such objects, as we remember to have once been altogether unknown to us; since we must be conscious of the utter inability, which we then lay under, of foretelling, what would arise from them. Present two smooth pieces of marble to a man, who has no tincture of natural philosophy; he will never discover, that they will adhere together, in such a manner as to require great force to separate them in a direct line, while they make so small a resistance to a lateral pressure. Such events, as bear little analogy to the common course of nature, are also readily confessed to be known only by experience; nor does any man imagine that the explosion of gunpowder, or the attraction of a loadstone, could ever be discovered by arguments à priori. In like manner, when an effect is supposed to depend upon an intricate machinery or secret structure of parts, we make no difficulty in attributing all our knowledge of it to experience. Who will assert, that he can give the ultimate reason, why milk or bread is proper nourishment for a man, not for a lion or a tiger?

But the same truth may not appear, at first sight, to have the same evidence with regard to events, which have become familiar to us from
our first appearance in the world, which bear a close analogy to the whole course of nature, and which are supposed to depend on the simple qualities of objects, without any secret structure of parts. We are apt to imagine, that we could discover these effects by the mere operation of our reason, without experience. We fancy, that were we brought, on a sudden, into this world, we could at first have inferred, that one Billiard-ball would communicate motion to another upon impulse; and that we needed not to have waited for the event, in order to pronounce with certainty concerning it. Such is the influence of custom, that, where it is strongest, it not only covers our natural ignorance, but even conceals itself, and seems not to take place, merely because it is found in the highest degree.

But to convince us, that all the laws of nature, and all the operations of bodies without exception, are known only by experience, the following reflections may, perhaps, suffice. Were any object presented to us, and were we required to pronounce concerning the effect, which will result from it, without consulting past observation; after what manner, I beseech you, must the mind proceed in this operation? It must invent or imagine some event, which it ascribes to the object as its effect; and it is plain that this invention must be entirely arbitrary. The mind can never possibly find the effect in the supposed cause, by the most accurate scrutiny and examination. For the effect is totally different from the cause, and consequently can never be discovered in it. Motion in the second Billiard-ball is a quite distinct event from motion in the first; nor is there any thing in the one to suggest the smallest hint of the other. A stone or piece of metal raised into the air, and left without any support, immediately falls: But to consider the matter à priori, is there any thing we discover in this situation, which can beget the idea of a downward, rather than an upward, or any other motion, in the stone or metal?

And as the first imagination or invention of a particular effect, in all natural operations, is arbitrary, where we consult not experience; so must we also esteem the supposed tie or connectio between the cause and effect, which binds them together, and renders it impossible, that any other effect could result from the operation of that cause. When I see, for instance, a Billiard-ball moving in a straight line
towards another; even suppose motion in the second ball should by accident be suggested to me, as the result of their contact or impulse; may I not conceive, that a hundred different events might as well follow from that cause? May not both these balls remain at absolute rest? May not the first ball return in a straight line, or leap off from the second in any line or direction? All these suppositions are consistent and conceivable. Why then should we give the preference to one, which is no more consistent or conceivable than the rest? All our reasonings à priori will never be able to shew us any foundation for this preference.

In a word, then, every effect is a distinct event from its cause. It could not, therefore, be discovered in the cause, and the first invention or conception of it, à priori, must be entirely arbitrary. And even after it is suggested, the conjunction of it with the cause must appear equally arbitrary; since there are always many other effects, which, to reason, must seem fully as consistent and natural. In vain, therefore, should we pretend to determine any single event, or infer any cause or effect, without the assistance of observation and experience.

Hence we may discover the reason, why no philosopher, who is rational and modest, has ever pretended to assign the ultimate cause of any natural operation, or to show distinctly the action of that power, which produces any single effect in the universe. It is confessed, that the utmost effort of human reason is, to reduce the principles, productive of natural phenomena, to a greater simplicity, and to resolve the many particular effects into a few general causes, by means of reasonings from analogy, experience, and observation. But as to the causes of these general causes, we should in vain attempt their discovery; nor shall we ever be able to satisfy ourselves, by any particular explication of them. These ultimate springs and principles are totally shut up from human curiosity and enquiry. Elasticity, gravity, cohesion of parts, communication of motion by impulse; these are probably the ultimate causes and principles which we shall ever discover in nature; and we may esteem ourselves sufficiently happy, if, by accurate enquiry and reasoning, we can trace up the particular phenomena to, or near to, these general principles. The most perfect philosophy of the natural kind only staves off our ignorance a little longer: As
perhaps the most perfect philosophy of the moral or metaphysical kind serves only to discover larger portions of it. Thus the observation of human blindness and weakness is the result of all philosophy, and meets us, at every turn, in spite of our endeavours to elude or avoid it.

Nor is geometry, when taken into the assistance of natural philosophy, ever able to remedy this defect, or lead us into the knowledge of ultimate causes, by all that accuracy of reasoning, for which it is so justly celebrated. Every part of mixed mathematics proceeds upon the supposition, that certain laws are established by nature in her operations; and abstract reasonings are employed, either to assist experience in the discovery of these laws, or to determine their influence in particular instances, where it depends upon any precise degree of distance and quantity. Thus, it is a law of motion, discovered by experience, that the moment or force of any body in motion is in the compound ratio or proportion of its solid contents and its velocity; and consequently, that a small force may remove the greatest obstacle or raise the greatest weight, if, by any contrivance or machinery, we can encrease the velocity of that force, so as to make it an overmatch for its antagonist. Geometry assists us in the application of this law, by giving us the just dimensions of all the parts and figures, which can enter into any species of machine; but still the discovery of the law itself is owing merely to experience, and all the abstract reasonings in the world could never lead us one step towards the knowledge of it. When we reason à priori, and consider merely any object or cause, as it appears to the mind, independent of all observation, it never could suggest to us the notion of any distinct object, such as its effect; much less, shew us the inseparable and inviolable connection between them. A man must be very sagacious, who could discover by reasoning, that crystal is the effect of heat, and ice of cold, without being previously acquainted with the operation of these qualities.
PART II.

But we have not, yet, attained any tolerable satisfaction with regard to the question first proposed. Each solution still gives rise to a new question as difficult as the foregoing, and leads us on to farther enquiries. When it is asked, What is the nature of all our reasonings concerning matter of fact? the proper answer seems to be, that they are founded on the relation of cause and effect. When again it is asked, What is the foundation of all our reasonings and conclusions concerning that relation? it may be replied in one word, Experience. But if we still carry on our sifting humour, and ask, What is the foundation of all conclusions from experience? this implies a new question, which may be of more difficult solution and explication. Philosophers, that give themselves airs of superior wisdom and sufficiency, have a hard task, when they encounter persons of inquisitive dispositions, who push them from every corner, to which they retreat, and who are sure at last to bring them to some dangerous dilemma. The best expedient to prevent this confusion, is to be modest in our pretensions; and even to discover the difficulty ourselves before it is objected to us. By this means, we may make a kind of merit of our very ignorance.

I shall content myself, in this section, with an easy task, and shall pretend only to give a negative answer to the question here proposed. I say then, that, even after we have experience of the operations of cause and effect, our conclusions from that experience are not founded on reasoning, or any process of the understanding. This answer we must endeavour, both to explain and to defend.

It must certainly be allowed, that nature has kept us at a great distance from all her secrets, and has afforded us only the knowledge
of a few superficial qualities of objects; while she conceals from us those powers and principles, on which the influence of these objects entirely depends. Our senses inform us of the colour, weight, and consistence of bread; but neither sense nor reason can ever inform us of those qualities, which fit it for the nourishment and support of a human body. Sight or feeling conveys an idea of the actual motion of bodies; but as to that wonderful force or power, which would carry on a moving body for ever in a continued change of place, and which bodies never lose but by communicating it to others; of this we cannot form the most distant conception. But notwithstanding this ignorance of natural powers and principles, we always presume, when we see like sensible qualities, that they have like secret powers, and expect, that effects, similar to those which we have experienced, will follow from them. If a body of like colour and consistence with that bread, which we have formerly eat, be presented to us, we make no scruple of repeating the experiment, and foresee, with certainty, like nourishment and support. Now this is a process of the mind or thought, of which I would willingly know the foundation. It is allowed on all hands, that there is no known connection between the sensible qualities and the secret powers; and consequently, that the mind is not led to form such a conclusion concerning their constant and regular conjunction, by any thing which it knows of their nature. As to past Experience, it can be allowed to give direct and certain information of those precise objects only, and that precise period of time, which fell under its cognizance: But why this experience should be extended to future times, and to other objects, which for aught we know, may be only in appearance similar; this is the main question on which I would insist. The bread, which I formerly eat, nourished me; that is, a body of such sensible qualities, was, at that time, endued with such secret powers: But does it follow, that other bread must also nourish me at another time, and that like sensible qualities must always be attended with like secret powers? The consequence seems nowise necessary. At least, it must be acknowledged, that there is here a

1 The word, Power, is here used in a loose and popular sense. The more accurate explication of it would give additional evidence to this argument. See Sect. 7.
consequence drawn by the mind; that there is a certain step taken; a process of thought, and an inference, which wants to be explained. These two propositions are far from being the same, I have found that such an object has always been attended with such an effect, and I foresee, that other objects, which are, in appearance, similar, will be attended with similar effects. I shall allow, if you please, that the one proposition may justly be inferred from the other: I know in fact, that it always is inferred. But if you insist, that the inference is made by a chain of reasoning, I desire you to produce that reasoning. The connection between these propositions is not intuitive. There is required a medium, which may enable the mind to draw such an inference, if indeed it be drawn by reasoning and argument. What that medium is, I must confess, passes my comprehension; and it is incumbent on those to produce it, who assert, that it really exists, and is the origin of all our conclusions concerning matter of fact.

This negative argument must certainly, in process of time, become altogether convincing, if many penetrating and able philosophers shall turn their enquiries this way; and no one be ever able to discover any connecting proposition or intermediate step, which supports the understanding in this conclusion. But as the question is yet new, every reader may not trust so far to his own penetration, as to conclude, because an argument escapes his enquiry, that therefore it does not really exist. For this reason it may be requisite to venture upon a more difficult task; and enumerating all the branches of human knowledge, endeavour to shew, that none of them can afford such an argument.

All reasonings may be divided into two kinds, namely demonstrative reasoning, or that concerning relations of ideas, and moral reasoning, or that concerning matter of fact and existence. That there are no demonstrative arguments in the case, seems evident; since it implies no contradiction, that the course of nature may change, and that an object, seemingly like those which we have experienced, may be attended with different or contrary effects. May I not clearly and distinctly conceive, that a body, falling from the clouds, and which, in all other respects, resembles snow, has yet the taste of salt or feeling of fire? Is there any more intelligible proposition than to affirm, that all the trees will flourish in December and January, and decay
in May and June? Now whatever is intelligible, and can be distinctly conceived, implies no contradiction, and can never be proved false by any demonstrative argument or abstract reasoning à priori.

If we be, therefore, engaged by arguments to put trust in past experience, and make it the standard of our future judgment, these arguments must be probable only, or such as regard matter of fact and real existence, according to the division above mentioned. But that there is no argument of this kind, must appear, if our explication of that species of reasoning be admitted as solid and satisfactory. We have said, that all arguments concerning existence are founded on the relation of cause and effect; that our knowledge of that relation is derived entirely from experience; and that all our experimental conclusions proceed upon the supposition, that the future will be conformable to the past. To endeavour, therefore, the proof of this last supposition by probable arguments, or arguments regarding existence, must be evidently going in a circle, and taking that for granted, which is the very point in question.

In reality, all arguments from experience are founded on the similarity, which we discover among natural objects, and by which we are induced to expect effects similar to those, which we have found to follow from such objects. And though none but a fool or madman will ever pretend to dispute the authority of experience, or to reject that great guide of human life; it may surely be allowed a philosopher to have so much curiosity at least, as to examine the principle of human nature, which gives this mighty authority to experience, and makes us draw advantage from that similarity, which nature has placed among different objects. From causes, which appear similar, we expect similar effects. This is the sum of all our experimental conclusions. Now it seems evident, that, if this conclusion were formed by reason, it would be as perfect at first, and upon one instance, as after ever so long a course of experience. But the case is far otherwise. Nothing so like as eggs; yet no one, on account of this appearing similarity, expects the same taste and relish in all of them. It is only after a long course of uniform experiments in any kind, that we attain a firm reliance and security with regard to a particular event. Now where is that process of reasoning, which, from one instance, draws a conclusion,
so different from that which it infers from a hundred instances, that
are nowise different from that single one? This question I propose
as much for the sake of information, as with an intention of raising
difficulties. I cannot find, I cannot imagine any such reasoning. But
I keep my mind still open to instruction, if any one will vouchsafe to
bestow it on me.

Should it be said, that, from a number of uniform experiments,
we infer a connection between the sensible qualities and the secret
powers; this, I must confess, seems the same difficulty, couched in dif-
ferent terms. The question still recurs, on what process of argument
this inference is founded? Where is the medium, the interposing ideas,
which join propositions so very wide of each other? It is confessed, that
the colour, consistence, and other sensible qualities of bread appear
not, of themselves, to have any connection with the secret powers of
nourishment and support. For otherwise we could infer these secret
powers from the first appearance of these sensible qualities, without
the aid of experience; contrary to the sentiment of all philosophers,
and contrary to plain matter of fact. Here then is our natural state
of ignorance with regard to the powers and influence of all objects.
How is this remedied by experience? It only shews us a number of
uniform effects, resulting from certain objects, and teaches us, that
those particular objects, at that particular time, were endowed with
such powers and forces. When a new object, endowed with similar
sensible qualities, is produced, we expect similar powers and forces,
and look for a like effect. From a body of like colour and consistence
with bread, we expect like nourishment and support. But this surely
is a step or progress of the mind, which wants to be explained. When
a man says, I have found, in all past instances, such sensible qualities
conjoined with such secret powers: And when he says, similar sensible
qualities will always be conjoined with similar secret powers; he is not
guilty of a tautology, nor are these propositions in any respect the
same. You say that the one proposition is an inference from the other.
But you must confess that the inference is not intuitive; neither is it
demonstrative: Of what nature is it then? To say it is experimental, is
begging the question. For all inferences from experience suppose,
as their foundation, that the future will resemble the past, and that
similar powers will be conjoined with similar sensible qualities. If there be any suspicion, that the course of nature may change, and that the past may be no rule for the future, all experience becomes useless, and can give rise to no inference or conclusion. It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future; since all these arguments are founded on the supposition of that resemblance. Let the course of things be allowed hitherto ever so regular; that alone, without some new argument or inference, proves not, that, for the future, it will continue so. In vain do you pretend to have learned the nature of bodies from your past experience. Their secret nature, and consequently, all their effects and influence, may change, without any change in their sensible qualities. This happens sometimes, and with regard to some objects: Why may it not happen always, and with regard to all objects? What logic, what process of argument secures you against this supposition? My practice, you say, refutes my doubts. But you mistake the purport of my question. As an agent, I am quite satisfied in the point; but as a philosopher, who has some share of curiosity, I will not say scepticism, I want to learn the foundation of this inference. No reading, no enquiry has yet been able to remove my difficulty, or give me satisfaction in a matter of such importance. Can I do better than propose the difficulty to the public, even though, perhaps, I have small hopes of obtaining a solution? We shall at least, by this means, be sensible of our ignorance, if we do not augment our knowledge.

I must confess, that a man is guilty of unpardonable arrogance, who concludes, because an argument has escaped his own investigation, that therefore it does not really exist. I must also confess, that, though all the learned, for several ages, should have employed themselves in fruitless search upon any subject, it may still, perhaps, be rash to conclude positively, that the subject must, therefore, pass all human comprehension. Even though we examine all the sources of our knowledge, and conclude them unfit for such a subject, there may still remain a suspicion, that the enumeration is not complete, or the examination not accurate. But with regard to the present subject, there are some considerations, which seem to remove all this accusation of arrogance or suspicion of mistake.
It is certain, that the most ignorant and stupid peasants, nay infants, nay even brute beasts, improve by experience, and learn the qualities of natural objects, by observing the effects, which result from them. When a child has felt the sensation of pain from touching the flame of a candle, he will be careful not to put his hand near any candle; but will expect a similar effect from a cause, which is similar in its sensible qualities and appearance. If you assert, therefore, that the understanding of the child is led into this conclusion by any process of argument or ratiocination, I may justly require you to produce that argument; nor have you any pretence to refuse so equitable a demand. You cannot say, that the argument is abstruse, and may possibly escape your enquiry; since you confess, that it is obvious to the capacity of a mere infant. If you hesitate, therefore, a moment, or if, after reflection, you produce any intricate or profound argument, you, in a manner, give up the question, and confess, that it is not reasoning which engages us to suppose the past resembling the future, and to expect similar effects from causes, which are, to appearance, similar. This is the proposition which I intended to enforce in the present section. If I be right, I pretend not to have made any mighty discovery. And if I be wrong, I must acknowledge myself to be indeed a very backward scholar; since I cannot now discover an argument, which, it seems, was perfectly familiar to me, long before I was out of my cradle.
SECTION V.

Sceptical Solution

of these Doubts.
PART I.

The passion for philosophy, like that for religion, seems liable to this inconvenience, that, though it aims at the correction of our manners, and extirpation of our vices, it may only serve, by imprudent management, to foster a predominant inclination, and push the mind, with more determined resolution, towards that side, which already draws too much, by the bias and propensity of the natural temper. It is certain, that, while we aspire to the magnanimous firmness of the philosophic sage, and endeavour to confine our pleasures altogether within our own minds, we may, at last, render our philosophy like that of Epictetus, and other Stoics, only a more refined system of selfishness, and reason ourselves out of all virtue, as well as social enjoyment. While we study with attention the vanity of human life, and turn all our thoughts towards the empty and transitory nature of riches and honours, we are, perhaps, all the while, flattering our natural indolence, which, hating the bustle of the world, and drudgery of business, seeks a pretence of reason, to give itself a full and uncontrouled indulgence. There is, however, one species of philosophy, which seems little liable to this inconvenience, and that because it strikes in with no disorderly passion of the human mind, nor can mingle itself with any natural affection or propensity; and that is the Academic or Sceptical philosophy. The academics always talk of doubt and suspense of judgment, of danger in hasty determinations, of confining to very narrow bounds the enquiries of the understanding, and of renouncing all speculations which lie not within the limits of common life and practice. Nothing, therefore, can be more contrary than such a philosophy to the supine indolence of
the mind, its rash arrogance, its lofty pretensions, and its superstitious credulity. Every passion is mortified by it, except the love of truth; and that passion never is, nor can be carried to too high a degree. It is surprising, therefore, that this philosophy, which, in almost every instance, must be harmless and innocent, should be the subject of so much groundless reproach and obloquy. But, perhaps, the very circumstance, which renders it so innocent, is what chiefly exposes it to the public hatred and resentment. By flattering no irregular passion, it gains few partizans: By opposing so many vices and follies, it raises to itself abundance of enemies, who stigmatize it as libertine, profane, and irreligious.

Nor need we fear, that this philosophy, while it endeavours to limit our enquiries to common life, should ever undermine the reasonings of common life, and carry its doubts so far as to destroy all action, as well as speculation. Nature will always maintain her rights, and prevail in the end over any abstract reasoning whatsoever. Though we should conclude, for instance, as in the foregoing section, that, in all reasonings from experience, there is a step taken by the mind, which is not supported by any argument or process of the understanding; there is no danger, that these reasonings, on which almost all knowledge depends, will ever be affected by such a discovery. If the mind be not engaged by argument to make this step, it must be induced by some other principle of equal weight and authority; and that principle will preserve its influence as long as human nature remains the same. What that principle is, may well be worth the pains of enquiry.

Suppose a person, though endowed with the strongest faculties of reason and reflection, to be brought on a sudden into this world; he would, indeed, immediately observe a continual succession of objects, and one event following another; but he would not be able to discover any thing farther. He would not, at first, by any reasoning, be able to reach the idea of cause and effect; since the particular powers, by which all natural operations are performed, never appear to the senses; nor is it reasonable to conclude, merely because one event, in one instance, precedes another, that therefore the one is the cause, the other the effect. Their conjunction may be arbitrary and casual. There may be no reason to infer the existence of one from
the appearance of the other. And in a word, such a person, without more experience, could never employ his conjecture or reasoning concerning any matter of fact, or be assured of any thing beyond what was immediately present to his memory and senses.

Suppose again, that he has acquired more experience, and has lived so long in the world as to have observed similar objects or events to be constantly conjoined together; what is the consequences of this experience? He immediately infers the existence of one object from the appearance of the other. Yet he has not, by all his experience, acquired any idea or knowledge of the secret power, by which the one object produces the other; nor is it, by any process of reasoning, he is engaged to draw this inference. But still he finds himself determined to draw it: And though he should be convinced, that his understanding has no part in the operation, he would nevertheless continue in the same course of thinking. There is some other principle, which determines him to form such a conclusion.

This principle is Custom or Habit. For wherever the repetition of any particular act or operation produces a propensity to renew the same act or operation, without being impelled by any reasoning or process of the understanding; we always say, that this propensity is the effect of Custom. By employing that word, we pretend not to have given the ultimate reason of such a propensity. We only point out a principle of human nature, which is universally acknowledged, and which is well known by its effects. Perhaps, we can push our enquiries no farther, or pretend to give the cause of this cause; but must rest contented with it as the ultimate principle, which we can assign, of all our conclusions from experience. It is sufficient satisfaction, that we can go so far; without repining at the narrowness of our faculties, because they will carry us no farther. And it is certain we here advance a very intelligible proposition at least, if not a true one, when we assert, that, after the constant conjunction of two objects, heat and flame, for instance, weight and solidity, we are determined by custom alone to expect the one from the appearance of the other. This hypothesis seems even the only one, which explains the difficulty, why we draw, from a thousand instances, an inference, which we are not able to draw from one instance, that is, in no respect, different from them.
Reason is incapable of any such variation. The conclusions, which it draws from considering one circle, are the same which it would form upon surveying all the circles in the universe. But no man, having seen only one body move after being impelled by another, could infer, that every other body will move after a like impulse. All inferences from experience, therefore, are effects of custom, not of reasoning.

2 Nothing is more usual than for writers, even, on moral, political, or physical subjects, to distinguish between reason and experience, and to suppose, that these species of argumentation are entirely different from each other. The former are taken for the mere result of our intellectual faculties, which, by considering à priori the nature of things, and examining the effects, that must follow from their operation, establish particular principles of science and philosophy. The latter are supposed to be derived entirely from sense and observation, by which we learn what has actually resulted from the operation of particular objects, and are thence able to infer, what will, for the future, result from them. Thus, for instance, the limitations and restraints of civil government, and a legal constitution, may be defended, either from reason, which reflecting on the great frailty and corruption of human nature, teaches, that no man can safely be trusted with unlimited authority; or from experience and history, which inform us of the enormous abuses, that ambition, in every age and country, has been found to make of so imprudent a confidence.

The same distinction between reason and experience is maintained in all our deliberations concerning the conduct of life; while the experienced statesman, general, physician, or merchant is trusted and followed; and the unpractised novice, with whatever natural talents endowed, neglected and despised. Though it be allowed, that reason may form very plausible conjectures with regard to the consequences of such a particular conduct in such particular circumstances; it is still supposed imperfect, without the assistance of experience, which is alone able to give stability and certainty to the maxims, derived from study and reflection.

But notwithstanding that this distinction be thus universally received, both in the active and speculative scenes of life, I shall not scruple to pronounce, that it is, at bottom, erroneous, at least, superficial.

If we examine those arguments, which, in any of the sciences above-mentioned, are supposed to be the mere effects of reasoning and reflection, they will be found to terminate, at last, in some general principle or conclusion, for which we can assign no reason but observation and experience. The only difference between them and those maxims, which are vulgarly esteemed the result of pure experience, is, that the former cannot be established without some process of thought, and some reflection on what we have observed, in order to
Custom, then, is the great guide of human life. It is that principle alone, which renders our experience useful to us, and makes us expect, for the future, a similar train of events with those which have appeared in the past. Without the influence of custom, we should be entirely ignorant of every matter of fact, beyond what is immediately present to the memory and senses. We should never know how to adjust means to ends, or to employ our natural powers in the production of any effect. There would be an end at once of all action, as well as of the chief part of speculation.

But here it may be proper to remark, that though our conclusions from experience carry us beyond our memory and senses, and assure us of matters of fact, which happened in the most distant places and most remote ages; yet some fact must always be present to the senses or memory, from which we may first proceed in drawing these

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distinguish its circumstances, and trace its consequences: Whereas in the latter, the experienced event is exactly and fully similar to that which we infer as the result of any particular situation. The history of a Tiberius or a Nero makes us dread a like tyranny, were our monarchs freed from the restraints of laws and senates: But the observation of any fraud or cruelty in private life is sufficient, with the aid of a little thought, to give us the same apprehension; while it serves as an instance of the general corruption of human nature, and shews us the danger which we must incur by reposing an entire confidence in mankind. In both cases, it is experience which is ultimately the foundation of our inference and conclusion.

There is no man so young and unexperienced, as not to have formed, from observation, many general and just maxims concerning human affairs and the conduct of life; but it must be confessed, that, when a man comes to put these in practice, he will be extremely liable to error, till time and farther experience both enlarge these maxims, and teach him their proper use and application. In every situation or incident, there are many particular and seemingly minute circumstances, which the man of greatest talents is, at first, apt to overlook, though on them the justness of his conclusions, and consequently the prudence of his conduct, entirely depend. Not to mention, that, to a young beginner, the general observations and maxims occur not always on the proper occasions, nor can be immediately applied with due calmness and distinction. The truth is, an unexperienced reasoner could be no reasoner at all, were he absolutely unexperienced; and when we assign that character to any one, we mean it only in a comparative sense, and suppose him possessed of experience, in a smaller and more imperfect degree.
conclusions. A man, who should find in a desert country the remains of pompous buildings, would conclude, that the country had, in ancient times, been cultivated by civilized inhabitants; but did nothing of this nature occur to him, he could never form such an inference. We learn the events of former ages from history; but then we must peruse the volumes, in which this instruction is contained, and thence carry up our inferences from one testimony to another, till we arrive at the eye-witnesses and spectators of these distant events. In a word, if we proceed not upon some fact, present to the memory or senses, our reasonings would be merely hypothetical; and however the particular links might be connected with each other, the whole chain of inferences would have nothing to support it, nor could we ever, by its means, arrive at the knowledge of any real existence. If I ask, why you believe any particular matter of fact, which you relate, you must tell me some reason; and this reason will be some other fact, connected with it. But as you cannot proceed after this manner, in infinitum, you must at last terminate in some fact, which is present to your memory or senses; or must allow that your belief is entirely without foundation.

What then is the conclusion of the whole matter? A simple one; though, it must be confessed, pretty remote from the common theories of philosophy. All belief of matter of fact or real existence is derived merely from some object, present to the memory or senses, and a customary conjunction between that and some other object. Or in other words; having found, in many instances, that any two kinds of objects, flame and heat, snow and cold, have always been conjoined together; if flame or snow be presented anew to the senses, the mind is carried by custom to expect heat or cold, and to believe, that such a quality does exist, and will discover itself upon a nearer approach. This belief is the necessary result of placing the mind in such circumstances. It is an operation of the soul, when we are so situated, as unavoidable as to feel the passion of love, when we receive benefits; or hatred, when we meet with injuries. All these operations are a species of natural instincts, which no reasoning or process of the thought and understanding is able, either to produce, or to prevent.

At this point, it would be very allowable for us to stop our philosophical researches. In most questions, we can never make a single
step farther; and in all questions, we must terminate here at last, after our most restless and curious enquiries. But still our curiosity will be pardonable, perhaps commendable, if it carry us on to still farther researches, and make us examine more accurately the nature of this belief, and of the customary conjunction, whence it is derived. By this means we may meet with some explications and analogies, that will give satisfaction; at least to such as love the abstract sciences, and can be entertained with speculations, which, however accurate, may still retain a degree of doubt and uncertainty. As to readers of a different taste; the remaining part of this section is not calculated for them, and the following enquiries may well be understood, though it be neglected.
PART II.

Nothing is more free than the imagination of man; and though it cannot exceed that original stock of ideas, furnished by the internal and external senses, it has unlimited power of mixing, compounding, separating, and dividing these ideas, in all the varieties of fiction and vision. It can feign a train of events, with all the appearance of reality, ascribe to them a particular time and place, conceive them as existent, and paint them out to itself with every circumstance, that belongs to any historical fact, which it believes with the greatest certainty. Wherein, therefore, consists the difference between such a fiction and belief? It lies not merely in any peculiar idea, which is annexed to such a conception as commands our assent, and which is wanting to every known fiction. For as the mind has authority over all its ideas, it could voluntarily annex this particular idea to any fiction, and consequently be able to believe whatever it pleases; contrary to what we find by daily experience. We can, in our conception, join the head of a man to the body of a horse; but it is not in our power to believe, that such an animal has ever really existed.

It follows, therefore, that the difference between fiction and belief lies in some sentiment or feeling, which is annexed to the latter, not to the former, and which depends not on the will, nor can be commanded at pleasure. It must be excited by nature, like all other sentiments; and must arise from the particular situation, in which the mind is placed at any particular juncture. Whenever any object is presented to the memory or senses, it immediately, by the force of custom, carries the imagination to conceive that object, which is usually conjoined to it; and this conception is attended with a feeling
or sentiment, different from the loose reveries of the fancy. In this consists the whole nature of belief. For as there is no matter of fact which we believe so firmly, that we cannot conceive the contrary, there would be no difference between the conception assented to, and that which is rejected, were it not for some sentiment, which distinguishes the one from the other. If I see a billiard-ball moving towards another, on a smooth table, I can easily conceive it to stop upon contact. This conception implies no contradiction; but still it feels very differently from that conception, by which I represent to myself the impulse, and the communication of motion from one ball to another.

Were we to attempt a definition of this sentiment, we should, perhaps, find it a very difficult, if not an impossible task; in the same manner as if we should endeavour to define the feeling of cold or passion of anger, to a creature who never had any experience of these sentiments. Belief is the true and proper name of this feeling; and no one is ever at a loss to know the meaning of that term; because every man is every moment conscious of the sentiment represented by it. It may not, however, be improper to attempt a description of this sentiment; in hopes we may, by that means, arrive at some analogies, which may afford a more perfect explication of it. I say then, that belief is nothing but a more vivid, lively, forcible, firm, steady conception of an object, than what the imagination alone is ever able to attain. This variety of terms, which may seem so unphilosophical, is intended only to express that act of the mind, which renders realities, or what is taken for such, more present to us than fictions, causes them to weigh more in the thought, and gives them a superior influence on the passions and imagination. Provided we agree about the thing, it is needless to dispute about the terms. The imagination has the command over all its ideas, and can join and mix and vary them, in all the ways possible. It may conceive fictitious objects with all the circumstances of place and time. It may set them, in a manner, before our eyes, in their true colours, just as they might have existed. But as it is impossible, that this faculty of imagination can ever, of itself, reach belief, it is evident, that belief consists not in the peculiar nature or order of ideas, but in the manner of their conception, and in their feeling to the mind. I confess, that it is impossible perfectly to explain this feeling or manner.
of conception. We may make use of words, which express something near it. But its true and proper name, as we observed before, is belief; which is a term, that every one sufficiently understands in common life. And in philosophy, we can go no farther than assert, that belief is something felt by the mind, which distinguishes the ideas of the judgment from the fictions of the imagination. It gives them more weight and influence; makes them appear of greater importance; inforces them in the mind; and renders them the governing principle of our actions. I hear at present, for instance, a person’s voice, with whom I am acquainted; and the sound comes as from the next room. This impression of my senses immediately conveys my thought to the person, together with all the surrounding objects. I paint them out to myself as existing at present, with the same qualities and relations, of which I formerly knew them possessed. These ideas take faster hold of my mind, than ideas of an enchanted castle. They are very different to the feeling, and have a much greater influence of every kind, either to give pleasure or pain, joy or sorrow.

Let us, then, take in the whole compass of this doctrine, and allow, that the sentiment of belief is nothing but a conception more intense and steady than what attends the mere fictions of the imagination, and that this manner of conception arises from a customary conjunction of the object with something present to the memory or senses: I believe that it will not be difficult, upon these suppositions, to find other operations of the mind analogous to it, and to trace up these phenomena to principles still more general.

We have already observed, that nature has established connections among particular ideas, and that no sooner one idea occurs to our thoughts than it introduces its correlative, and carries our attention towards it, by a gentle and insensible movement. These principles of connection or association we have reduced to three, namely, Resemblance, Contiguity, and Causation; which are the only bonds, that unite our thoughts together, and beget that regular train of reflection or discourse, which, in a greater or less degree, takes place among all mankind. Now here arises a question, on which the solution of the present difficulty will depend. Does it happen, in all these relations, that, when one of the objects is presented to the senses or memory,
the mind is not only carried to the conception of the correlative, but reaches a steadier and stronger conception of it than what otherwise it would have been able to attain? This seems to be the case with that belief, which arises from the relation of cause and effect. And if the case be the same with the other relations or principles of association, this may be established as a general law, which takes place in all the operations of the mind.

We may, therefore, observe, as the first experiment to our present purpose, that, upon the appearance of the picture of an absent friend, our idea of him is evidently enlivened by the resemblance, and that every passion, which that idea occasions, whether of joy or sorrow, acquires new force and vigour. In producing this effect, there concur both a relation and a present impression. Where the picture bears him no resemblance, at least was not intended for him, it never so much as conveys our thought to him: And where it is absent, as well as the person; though the mind may pass from the thought of the one to that of the other; it feels its idea to be rather weakened than enlivened by that transition. We take a pleasure in viewing the picture of a friend, when it is set before us; but when it is removed, rather chose to consider him directly, than by reflection in an image, which is equally distant and obscure.

The ceremonies of the Roman Catholic religion may be considered as instances of the same nature. The devotees of that superstition usually plead in excuse for the mummeries, with which they are upbraided, that they feel the good effect of those external motions, and postures, and actions, in enlivening their devotion and quickening their fervour, which otherwise would decay, if directed entirely to distant and immaterial objects. We shadow out the objects of our faith, say they, in sensible types and images, and render them more present to us by the immediate presence of these types, than it is possible for us to do, merely by an intellectual view and contemplation. Sensible objects have always a greater influence on the fancy than any other; and this influence they readily convey to those ideas, to which they are related, and which they resemble. I shall only infer from these practices, and this reasoning, that the effect of resemblance in enlivening the ideas is very common; and as in every case a resemblance
and a present impression must concur, we are abundantly supplied
with experiments to prove the reality of the foregoing principle.

We may add force to these experiments by others of a different kind,
in considering the effects of contiguity as well as of resemblance. It is
certain, that distance diminishes the force of every idea, and that, upon
our approach to any object; though it does not discover itself to our
senses; it operates upon the mind with an influence, which imitates an
immediate impression. The thinking on any object readily transports
the mind to what is contiguous; but it is only the actual presence of an
object, that transports it with a superior vivacity. When I am a few miles
from home, whatever relates to it touches me more nearly than when
I am two hundred leagues distant; though even at that distance the
reflecting on any thing in the neighbourhood of my friends or family
naturally produces an idea of them. But as in this latter case, both the
objects of the mind are ideas; notwithstanding there is an easy transi-
tion between them; that transition alone is not able to give a superior
vivacity to any of the ideas, for want of some immediate impression.

No one can doubt but causation has the same influence as the
other two relations of resemblance and contiguity. Superstitious
people are fond of the relics of saints and holy men, for the same
reason, that they seek after types or images, in order to enliven their
devotion, and give them a more intimate and strong conception of
those exemplary lives, which they desire to imitate. Now it is evident,
that one of the best relics, which a devotee could procure, would be
the handywork of a saint; and if his cloaths and furniture are ever to

3  “Naturane nobis, inquit, datum dicam, an errore quodam, ut, cum ea loca
videamus, in quibus memoria dignos viros acceperimus multum esse versa-
tos, magis moveamur, quam siquando eorum ipsorum aut facta audiamus aut
scriptum aliquod legamus? Velut ego nunc moveor. Venit enim mihi Platonis
in mentem, quem accepius primum hic disputare solitum: Cujus etiam illi
hortuli propinqui non memoriam solum mihi afferunt, sed ipsum videntur in
conspectu meo hic ponere. His Speusippus, hic Xenocrates, hic ejus auditor
Polemo; cujus ipsa illa sessio fuit, quam videamus. Equidem etiam curiam nos-
tram, Hostiliam dico, non hanc novam, quæ mihi minor esse videtur postquam
est major, solebam intuens, Scipionem, Catonem, Lælius, nostrum vero in
primis avum cogitare. Tanta vis admonitionis est in locis; ut non sine causa ex
his memoriae deducta sit disciplina. Cicero de Finibus. Lib. v.
be considered in this light, it is because they were once at his disposal, and were moved and affected by him; in which respect they are to be considered as imperfect effects, and as connected with him by a shorter chain of consequences than any of those, by which we learn the reality of his existence.

Suppose, that the son of a friend, who had been long dead or absent, were presented to us; it is evident, that this object would instantly revive its correlative idea, and recall to our thoughts all past intimacies and familiarities, in more lively colours than they would otherwise have appeared to us. This is another phenomenon, which seems to prove the principle above-mentioned.

We may observe, that, in these phenomena, the belief of the correlative object is always presupposed; without which the relation could have no effect. The influence of the picture supposes, that we believe our friend to have once existed. Contiguity to home can never excite our ideas of home, unless we believe that it really exists. Now I assert, that this belief, where it reaches beyond the memory or senses, is of a similar nature, and arises from similar causes, with the transition of thought and vivacity of conception here explained. When I throw a piece of dry wood into a fire, my mind is immediately carried to conceive, that it augments, not extinguishes the flame. This transition of thought from the cause to the effect proceeds not from reason. It derives its origin altogether from custom and experience. And as it first begins from an object, present to the senses, it renders the idea or conception of flame more strong and lively than any loose, floating reverie of the imagination. That idea arises immediately. The thought moves instantly towards it, and conveys to it all that force of conception, which is derived from the impression present to the senses. When a sword is levelled at my breast, does not the idea of wound and pain strike me more strongly, than when a glass of wine is presented to me, even though by accident this idea should occur after the appearance of the latter object? But what is there in this whole matter to cause such a strong conception, except only a present object and a customary transition to the idea of another object, which we have been accustomed to conjoin with the former? This is the whole operation of the mind, in all our conclusions concerning matter of
fact and existence; and it is a satisfaction to find some analogies, by which it may be explained. The transition from a present object does in all cases give strength and solidity to the related idea.

Here, then, is a kind of pre-established harmony between the course of nature and the succession of our ideas; and though the powers and forces, by which the former is governed, be wholly unknown to us; yet our thoughts and conceptions have still, we find, gone on in the same train with the other works of nature. Custom is that principle, by which this correspondence has been effected; so necessary to the subsistence of our species, and the regulation of our conduct, in every circumstance and occurrence of human life. Had not the presence of an object instantly excited the idea of those objects, commonly conjoined with it, all our knowledge must have been limited to the narrow sphere of our memory and senses; and we should never have been able to adjust means to ends, or employ our natural powers, either to the producing of good, or avoiding of evil. Those, who delight in the discovery and contemplation of final causes, have here ample subject to employ their wonder and admiration.

I shall add, for a further confirmation of the foregoing theory, that, as this operation of the mind, by which we infer like effects from like causes, and vice versa, is so essential to the subsistence of all human creatures, it is not probable, that it could be trusted to the fallacious deductions of our reason, which is slow in its operations; appears not, in any degree, during the first years of infancy; and at best is, in every age and period of human life, extremely liable to error and mistake. It is more conformable to the ordinary wisdom of nature to secure so necessary an act of the mind, by some instinct or mechanical tendency, which may be infallible in its operations, may discover itself at the first appearance of life and thought, and may be independent of all the laboured deductions of the understanding. As nature has taught us the use of our limbs, without giving us the knowledge of the muscles and nerves, by which they are actuated; so has she implanted in us an instinct, which carries forward the thought in a correspondent course to that which she has established among external objects; though we are ignorant of those powers and forces, on which this regular course and succession of objects totally depends.
SECTION XII.

ACADEMICAL OR SCEPTICAL PHILOSOPHY

PART I.

There is not a greater number of philosophical reasonings, displayed upon any subject, than those, which prove the existence of a Deity, and refute the fallacies of Atheists; and yet the most religious philosophers still dispute whether any man can be so blinded as to be a speculative atheist. How shall we reconcile these contradictions?

The knights-errant, who wandered about to clear the world of dragons and giants, never entertained the least doubt with regard to the existence of these monsters.

The Sceptic is another enemy of religion, who naturally provokes the indignation of all divines and graver philosophers; though it is certain, that no man ever met with any such absurd creature, or conversed with a man, who had no opinion or principle concerning any subject, either of action or speculation. This begets a very natural question; What is meant by a sceptic? And how far it is possible to push these philosophical principles of doubt and uncertainty?

There is a species of scepticism, antecedent to all study and philosophy, which is much inculcated by Des Cartes and others, as a sovereign preservative against error and precipitate judgment. It recommends an universal doubt, not only of all our former opinions and principles, but also of our very faculties; of whose veracity, say
they, we must assure ourselves, by a chain of reasoning, deduced from some original principle, which cannot possibly be fallacious or deceitful. But neither is there any such original principle, which has a prerogative above others, that are self-evident and convincing: Or if there were, could we advance a step beyond it, but by the use of those very faculties, of which we are supposed to be already diffident. The Cartesian doubt, therefore, were it ever possible to be attained by any human creature (as it plainly is not) would be entirely incurable; and no reasoning could ever bring us to a state of assurance and conviction upon any subject.

It must, however, be confessed, that this species of scepticism, when more moderate, may be understood in a very reasonable sense, and is a necessary preparative to the study of philosophy, by preserving a proper impartiality in our judgments, and weaning our mind from all those prejudices, which we may have imbibed from education or rash opinion. To begin with clear and self-evident principles, to advance by timorous and sure steps, to review frequently our conclusions, and examine accurately all their consequences; though by these means we shall make both a slow and a short progress in our systems; are the only methods, by which we can ever hope to reach truth, and attain a proper stability and certainty in our determinations.

There is another species of scepticism, consequent to science and enquiry, when men are supposed to have discovered, either the absolute fallaciousness of their mental faculties, or their unfitness to reach any fixed determination in all those curious subjects of speculation, about which they are commonly employed. Even our very senses are brought into dispute, by a certain species of philosophers; and the maxims of common life are subjected to the same doubt as the most profound principles or conclusions of metaphysics and theology. As these paradoxical tenets (if they may be called tenets) are to be met with in some philosophers, and the refutation of them in several, they naturally excite our curiosity, and make us enquire into the arguments, on which they may be founded.

I need not insist upon the more trite topics, employed by the sceptics in all ages, against the evidence of sense; such as those which are derived from the imperfection and fallaciousness of our organs, on
numberless occasions; the crooked appearance of an oar in water; the various aspects of objects, according to their different distances; the double images which arise from the pressing one eye; with many other appearances of a like nature. These sceptical topics, indeed, are only sufficient to prove, that the senses alone are not implicitly to be depended on; but that we must correct their evidence by reason, and by considerations, derived from the nature of the medium, the distance of the object, and the disposition of the organ, in order to render them, within their sphere, the proper criteria of truth and falsehood. There are other more profound arguments against the senses, which admit not of so easy a solution.

It seems evident, that men are carried, by a natural instinct or prepossession, to repose faith in their senses; and that, without any reasoning, or even almost before the use of reason, we always suppose an external universe, which depends not on our perception, but would exist, though we and every sensible creature were absent or annihilated. Even the animal creation are governed by a like opinion, and preserve this belief of external objects, in all their thoughts, designs, and actions.

It seems also evident, that, when men follow this blind and powerful instinct of nature, they always suppose the very images, presented by the senses, to be the external objects, and never entertain any suspicion, that the one are nothing but representations of the other. This very table, which we see white, and which we feel hard, is believed to exist, independent of our perception, and to be something external to our mind, which perceives it. Our presence bestows not being on it: Our absence does not annihilate it. It preserves its existence uniform and entire, independent of the situation of intelligent beings, who perceive or contemplate it.

But this universal and primary opinion of all men is soon destroyed by the slightest philosophy, which teaches us, that nothing can ever be present to the mind but an image or perception, and that the senses are only the inlets, through which these images are conveyed, without being able to produce any immediate intercourse between the mind and the object. The table, which we see, seems to diminish, as we remove farther from it: But the real table, which exists independent
of us, suffers no alteration: It was, therefore, nothing but its image, which was present to the mind. These are the obvious dictates of reason; and no man, who reflects, ever doubted, that the existences, which we consider, when we say, this house and that tree, are nothing but perceptions in the mind, and fleeting copies or representations of other existences, which remain uniform and independent.

So far, then, are we necessitated by reasoning to contradict or depart from the primary instincts of nature, and to embrace a new system with regard to the evidence of our senses. But here philosophy finds herself extremely embarrassed, when she would justify this new system, and obviate the cavils and objections of the sceptics. She can no longer plead the infallible and irresistible instinct of nature: For that led us to a quite different system, which is acknowledged fallible and even erroneous. And to justify this pretended philosophical system, by a chain of clear and convincing argument, or even any appearance of argument, exceeds the power of all human capacity.

By what argument can it be proved, that the perceptions of the mind must be caused by external objects, entirely different from them, though resembling them (if that be possible) and could not arise either from the energy of the mind itself, or from the suggestion of some invisible and unknown spirit, or from some other cause still more unknown to us? It is acknowledged, that, in fact, many of these perceptions arise not from any thing external, as in dreams, madness, and other diseases. And nothing can be more inexplicable than the manner, in which body should so operate upon mind as ever to convey an image of itself to a substance, supposed of so different, and even contrary a nature.

It is a question of fact, whether the perceptions of the senses be produced by external objects, resembling them: How shall this question be determined? By experience surely; as all other questions of a like nature. But here experience is, and must be entirely silent. The mind has never any thing present to it but the perceptions, and cannot possibly reach any experience of their connection with objects. The supposition of such a connection is, therefore, without any foundation in reasoning.
To have recourse to the veracity of the supreme Being, in order to prove the veracity of our senses, is surely making a very unexpected circuit. If his veracity were at all concerned in this matter, our senses would be entirely infallible; because it is not possible that he can ever deceive. Not to mention, that, if the external world be once called in question, we shall be at a loss to find arguments, by which we may prove the existence of that Being or any of his attributes.

This is a topic, therefore, in which the profounder and more philosophical sceptics will always triumph, when they endeavour to introduce an universal doubt into all subjects of human knowledge and enquiry. Do you follow the instincts and propensities of nature, may they say, in assenting to the veracity of sense? But these lead you to believe, that the very perception or sensible image is the external object. Do you disclaim this principle, in order to embrace a more rational opinion, that the perceptions are only representations of something external? You here depart from your natural propensities and more obvious sentiments; and yet are not able to satisfy your reason, which can never find any convincing argument from experience to prove, that the perceptions are connected with any external objects.

There is another sceptical topic of a like nature, derived from the most profound philosophy; which might merit our attention, were it requisite to dive so deep, in order to discover arguments and reasonings, which can so little serve to any serious purpose. It is universally allowed by modern enquirers, that all the sensible qualities of objects, such as hard, soft, hot, cold, white, black, &c. are merely secondary, and exist not in the objects themselves, but are perceptions of the mind, without any external archetype or model, which they represent. If this be allowed, with regard to secondary qualities, it must also follow, with regard to the supposed primary qualities of extension and solidity; nor can the latter be any more entitled to that denomination than the former. The idea of extension is entirely acquired from the senses of sight and feeling; and if all the qualities, perceived by the senses, be in the mind, not in the object, the same conclusion must reach the idea of extension, which is wholly dependent on the sensible ideas or the ideas of secondary qualities. Nothing can save us from this conclusion, but the asserting, that the ideas of those primary
qualities are attained by Abstraction; an opinion, which, if we examine it accurately, we shall find to be unintelligible, and even absurd. An extension, that is neither tangible nor visible, cannot possibly be conceived: And a tangible or visible extension, which is neither hard nor soft, black nor white, is equally beyond the reach of human conception. Let any man try to conceive a triangle in general, which is neither Isosceles nor Scalenum, nor has any particular length or proportion of sides; and he will soon perceive the absurdity of all the scholastic notions with regard to abstraction and general ideas⁴.

Thus the first philosophical objection to the evidence of sense or to the opinion of external existence consists in this, that such an opinion, if rested on natural instinct, is contrary to reason, and if referred to reason, is contrary to natural instinct, and at the same time carries no rational evidence with it, to convince an impartial enquirer. The second objection goes farther, and represents this opinion as contrary to reason: at least, if it be a principle of reason, that all sensible qualities are in the mind, not in the object. Bereave matter of all its intelligible qualities, both primary and secondary, you in a manner annihilate it, and leave only a certain unknown, inexplicable something, as the cause of our perceptions; a notion so imperfect, that no sceptic will think it worth while to contend against it.

⁴ This argument is drawn from Dr. Berkley; and indeed most of the writings of that very ingenious author form the best lessons of scepticism, which are to be found either among the ancient or modern philosophers, Bayle not excepted. He professes, however, in his title-page (and undoubtedly with great truth) to have composed his book against the sceptics as well as against the atheists and free-thinkers. But that all his arguments, though otherwise intended, are, in reality, merely sceptical, appears from this, that they admit of no answer and produce no conviction. Their only effect is to cause that momentary amazement and irresolution and confusion, which is the result of scepticism.
PART II.

It may seem a very extravagant attempt of the sceptics to destroy reason by argument and ratiocination; yet is this the grand scope of all their enquiries and disputes. They endeavour to find objections, both to our abstract reasonings, and to those which regard matter of fact and existence.

The chief objection against all abstract reasonings is derived from the ideas of space and time; ideas, which, in common life and to a careless view, are very clear and intelligible, but when they pass through the scrutiny of the profound sciences (and they are the chief object of these sciences) afford principles, which seem full of absurdity and contradiction. No priestly dogmas, invented on purpose to tame and subdue the rebellious reason of mankind, ever shocked common sense more than the doctrine of the infinite divisibility of extension, with its consequences; as they are pompously displayed by all geometricians and metaphysicians, with a kind of triumph and exultation. A real quantity, infinitely less than any finite quantity, containing quantities infinitely less than itself, and so on in infinitum; this is an edifice so bold and prodigious, that it is too weighty for any pretended demonstration to support, because it shocks the clearest and most natural principles of human reason 5.

5 disputes there may be about mathematical points, we must allow that there are physical points; that is, parts of extension, which cannot be divided or lessened, either by the eye or imagination. These images, then, which are present to the fancy or senses, are absolutely indivisible, and consequently must be allowed by mathematicians to be infinitely less than any real part of extension; and yet nothing appears more certain to reason, than that an infinite number of them composes an infinite extension. How much more an infinite number of those infinitely small parts of extension, which are still supposed infinitely divisible.
But what renders the matter more extraordinary, is, that these seemingly absurd opinions are supported by a chain of reasoning, the clearest and most natural; nor is it possible for us to allow the premises without admitting the consequences. Nothing can be more convincing and satisfactory than all the conclusions concerning the properties of circles and triangles; and yet, when these are once received, how can we deny, that the angle of contact between a circle and its tangent is infinitely less than any rectilineal angle, that as you may increase the diameter of the circle in infinitum, this angle of contact becomes still less, even in infinitum, and that the angle of contact between other curves and their tangents may be infinitely less than those between any circle and its tangent, and so on, in infinitum? The demonstration of these principles seems as unexceptionable as that which proves the three angles of a triangle to be equal to two right ones, though the latter opinion be natural and easy, and the former big with contradiction and absurdity. Reason here seems to be thrown into a kind of amazement and suspense, which, without the suggestions of any sceptic, gives her a diffidence of herself, and of the ground on which she treads. She sees a full light, which illuminates certain places; but that light borders upon the most profound darkness. And between these she is so dazzled and confounded, that she scarcely can pronounce with certainty and assurance concerning any one object.

The absurdity of these bold determinations of the abstract sciences seems to become, if possible, still more palpable with regard to time than extension. An infinite number of real parts of time, passing in succession, and exhausted one after another, appears so evident a contradiction, that no man, one should think, whose judgment is not corrupted, instead of being improved, by the sciences, would ever be able to admit of it.

Yet still reason must remain restless, and unquiet, even with regard to that scepticism, to which she is driven by these seeming absurdities and contradictions. How any clear, distinct idea can contain circumstances, contradictory to itself, or to any other clear, distinct idea, is absolutely incomprehensible; and is, perhaps, as absurd as any proposition, which can be formed. So that nothing can be more sceptical, or more full of doubt and hesitation, than this scepticism itself, which
arises from some of the paradoxical conclusions of geometry or the science of quantity.

The sceptical objections to moral evidence, or to the reasonings concerning matter of fact, are either popular or philosophical. The popular objections are derived from the natural weakness of human understanding; the contradictory opinions, which have been entertained in different ages and nations; the variations of our judgment in sickness and health, youth and old age, prosperity and adversity; the perpetual contradiction of each particular man’s opinions and sentiments; with many other topics of that kind. It is needless to insist farther on this head. These objections are but weak. For as, in common life, we reason every moment concerning fact and existence, and cannot possibly subsist, without continually employing this species of argument, any popular objections, derived from thence, must be insufficient to destroy that evidence. The great subverter of Pyrrhonism or the excessive principles of scepticism, is action, and employment, and the occupations of common life. These principles may flourish and triumph in the schools; where it is, indeed, difficult, if not impossible, to refute them. But as soon as they leave the shade, and by the presence of the real objects, which actuate our passions

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6 It seems to me not impossible to avoid these absurdities and contradictions, if it be admitted, that there is no such thing as abstract or general ideas, properly speaking; but that all general ideas are, in reality, particular ones, attached to a general term, which recalls, upon occasion, other particular ones, that resemble, in certain circumstances, the idea, present to the mind. Thus when the term Horse is pronounced, we immediately figure to ourselves the idea of a black or a white animal, of a particular size or figure: But as that term is also usually applied to animals of other colours, figures and sizes, these ideas, though not actually present to the imagination, are easily recalled; and our reasoning and conclusion proceed in the same way, as if they were actually present. If this be admitted (as seems reasonable) it follows that all the ideas of quantity, upon which mathematicians reason, are nothing but particular, and such as are suggested by the senses and imagination, and consequently, cannot be infinitely divisible. It is sufficient to have dropped this hint at present, without prosecuting it any farther. It certainly concerns all lovers of science not to expose themselves to the ridicule and contempt of the ignorant by their conclusions; and this seems the readiest solution of these difficulties.
and sentiments, are put in opposition to the more powerful principles of our nature, they vanish like smoke, and leave the most determined sceptic in the same condition as other mortals.

The sceptic, therefore, had better keep within his proper sphere, and display those philosophical objections, which arise from more profound researches. Here he seems to have ample matter of triumph; while he justly insists, that all our evidence for any matter of fact, which lies beyond the testimony of sense or memory, is derived entirely from the relation of cause and effect; that we have no other idea of this relation than that of two objects, which have been frequently conjoined together; that we have no argument to convince us, that objects, which have, in our experience, been frequently conjoined, will likewise, in other instances, be conjoined in the same manner; and that nothing leads us to this inference but custom or a certain instinct of our nature; which it is indeed difficult to resist, but which, like other instincts, may be fallacious and deceitful. While the sceptic insists upon these topics, he shews his force, or rather, indeed, his own and our weakness; and seems, for the time at least, to destroy all assurance and conviction. These arguments might be displayed at greater length, if any durable good or benefit to society could ever be expected to result from them.

For here is the chief and most confounding objection to excessive scepticism, that no durable good can ever result from it; while it remains in its full force and vigour. We need only ask such a sceptic, What is his meaning? And what he proposes by all these curious researches? He is immediately at a loss, and knows not what to answer. A Copernican or Ptolemaic, who supports each his different system of astronomy, may hope to produce a conviction, which will remain constant and durable, with his audience. A Stoic or Epicurean displays principles, which may not only be durable, but which have an effect on conduct and behaviour. But a Pyrrhonian cannot expect, that his philosophy will have any constant influence on the mind: Or if it had, that its influence would be beneficial to society. On the contrary, he must acknowledge, if he will acknowledge any thing, that all human life must perish, were his principles universally and steadily to prevail. All discourse, all action would immediately cease; and men remain in
a total lethargy, till the necessities of nature, unsatisfied, put an end
to their miserable existence. It is true; so fatal an event is very little
to be dreaded. Nature is always too strong for principle. And though
a Pyrrhonian may throw himself or others into a momentary amaze-
ment and confusion by his profound reasonings; the first and most
trivial event in life will put to flight all his doubts and scruples, and
leave him the same, in every point of action and speculation, with the
philosophers of every other sect, or with those who never concerned
themselves in any philosophical researches. When he awakes from
his dream, he will be the first to join in the laugh against himself,
and to confess, that all his objections are mere amusement, and can
have no other tendency than to show the whimsical condition of man-
kind, who must act and reason and believe; though they are not able,
by their most diligent enquiry, to satisfy themselves concerning the
foundation of these operations, or to remove the objections, which
may be raised against them.
PART III.

There is, indeed, a more mitigated scepticism or academical-philosophy, which may be both durable and useful, and which may, in part, be the result of this Pyrrhonism, or excessivescepticism, when its undistinguished doubts are, in some measure, corrected by common sense and reflection. The greater part of mankind are naturally apt to be affirmative and dogmatical in their opinions; and while they see objects only on one side, and have no idea of any counterpoising argument, they throw themselves precipitately into the principles, to which they are inclined; nor have they any indulgence for those who entertain opposite sentiments. To hesitate or balance perplexes their understanding, checks their passion, and suspends their action. They are, therefore, impatient till they escape from a state, which to them is so uneasy; and they think, that they can never remove themselves far enough from it, by the violence of their affirmations and obstinacy of their belief. But could such dogmatical reasoners become sensible of the strange infirmities of human understanding, even in its most perfect state, and when most accurate and cautious in its determinations; such a reflection would naturally inspire them with more modesty and reserve, and diminish their fond opinion of themselves, and their prejudice against antagonists. The illiterate may reflect on the disposition of the learned, who, amidst all the advantages of study and reflection, are commonly still diffident in their determinations: And if any of the learned be inclined, from their natural temper, to haughtiness and obstinacy, a small tincture of Pyrrhonism might abate their pride, by shewing them, that the few advantages, which they may have attained over
their fellows, are but inconsiderable, if compared with the universal perplexity and confusion, which is inherent in human nature. In general, there is a degree of doubt, and caution, and modesty, which, in all kinds of scrutiny and decision, ought for ever to accompany a just reasoner.

Another species of mitigated scepticism, which may be of advantage to mankind, and which may be the natural result of the Pyrrhonian doubts and scruples, is the limitation of our enquiries to such subjects as are best adapted to the narrow capacity of human understanding. The imagination of man is naturally sublime, delighted with whatever is remote and extraordinary, and running, without control, into the most distant parts of space and time in order to avoid the objects, which custom has rendered too familiar to it. A correct Judgment observes a contrary method, and avoiding all distant and high enquiries, confines itself to common life, and to such subjects as fall under daily practice and experience; leaving the more sublime topics to the embellishment of poets and orators, or to the arts of priests and politicians. To bring us to so salutary a determination, nothing can be more serviceable, than to be once thoroughly convinced of the force of the Pyrrhonian doubt, and of the impossibility, that any thing, but the strong power of natural instinct, could free us from it. Those who have a propensity to philosophy, will still continue their researches; because they reflect, that, besides the immediate pleasure, attending such an occupation, philosophical decisions are nothing but the reflections of common life, methodized and corrected. But they will never be tempted to go beyond common life, so long as they consider the imperfection of those faculties which they employ, their narrow reach, and their inaccurate operations. While we cannot give a satisfactory reason, why we believe, after a thousand experiments, that a stone will fall, or fire burn; can we ever satisfy ourselves concerning any determination, which we may form, with regard to the origin of worlds, and the situation of nature, from, and to eternity?

This narrow limitation, indeed, of our enquiries, is, in every respect, so reasonable, that it suffices to make the slightest examination into the natural powers of the human mind, and to compare
them with their objects, in order to recommend it to us. We shall then find what are the proper subjects of science and enquiry.

It seems to me, that the only objects of the abstract sciences or of demonstration are quantity and number, and that all attempts to extend this more perfect species of knowledge beyond these bounds are mere sophistry and illusion. As the component parts of quantity and number are entirely similar, their relations become intricate and involved; and nothing can be more curious, as well as useful, than to trace, by a variety of mediums, their equality or inequality, through their different appearances. But as all other ideas are clearly distinct and different from each other, we can never advance farther, by our outmost scrutiny, than to observe this diversity, and, by an obvious reflection, pronounce one thing not to be another. Or if there be any difficulty in these decisions, it proceeds entirely from the undeterminate meaning of words, which is corrected by juster definitions. That the square of the hypothenuse is equal to the squares of the other two sides, cannot be known, let the terms be ever so exactly defined, without a train of reasoning and enquiry. But to convince us of this proposition, that where there is no property, there can be no injustice, it is only necessary to define the terms, and explain injustice to be a violation of property. This proposition is, indeed, nothing but a more imperfect definition. It is the same case with all those pretended syllogistical reasonings, which may be found in every other branch of learning, except the sciences of quantity and number; and these may safely, I think, be pronounced the only proper objects of knowledge and demonstration.

All other enquiries of men regard only matter of fact and existence; and these are evidently incapable of demonstration. Whatever is may not be. No negation of a fact can involve a contradiction. The non-existence of any being, without exception, is as clear and distinct an idea as its existence. The proposition, which affirms it not to be, however false, is no less conceivable and intelligible, than that which affirms it to be. The case is different with the sciences, properly so called. Every proposition, which is not true, is there confused and unintelligible. That the cube root of 64 is equal to the half of 10, is a false proposition, and can never be distinctly conceived. But that
Cæsar, or the angel Gabriel, or any being never existed, may be a false proposition, but still is perfectly conceivable, and implies no contradiction.

The existence, therefore, of any being can only be proved by arguments from its cause or its effect; and these arguments are founded entirely on experience. If we reason à priori, any thing may appear able to produce any thing. The falling of a pebble may, for ought we know, extinguish the sun; or the wish of a man control the planets in their orbits. It is only experience, which teaches us the nature and bounds of cause and effect, and enables us to infer the existence of one object from that of another. Such is the foundation of moral reasoning, which forms the greater part of human knowledge, and is the source of all human action and behaviour.

Moral reasonings are either concerning particular or general facts. All deliberations in life regard the former; as also all disquisitions in history, chronology, geography, and astronomy.

The sciences, which treat of general facts, are politics, natural philosophy, physic, chemistry, &c. where the qualities, causes and effects of a whole species of objects are enquired into.

Divinity or Theology, as it proves the existence of a Deity, and the immortality of souls, is composed partly of reasonings concerning particular, partly concerning general facts. It has a foundation in reason, so far as it is supported by experience. But its best and most solid foundation is faith and divine revelation.

Morals and criticism are not so properly objects of the understanding as of taste and sentiment. Beauty, whether moral or natural, is felt, more properly than perceived. Or if we reason concerning it, and endeavour to fix its standard, we regard a new fact, to wit, the general taste of mankind, or some such fact, which may be the object of reasoning and enquiry.

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7 That impious maxim of the ancient philosophy, *Ex nihilo, nihil fit* [out of nothing comes nothing], by which the creation of matter was excluded, ceases to be a maxim, according to this philosophy. Not only the will of the supreme Being may create matter; but, for aught we know à priori, the will of any other being might create it, or any other cause, that the most whimsical imagination can assign.
When we run over libraries, persuaded of these principles, what havoc must we make? If we take in our hand any volume; of divinity or school metaphysics, for instance; let us ask, Does it contain any abstract reasoning concerning quantity or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames: For it can contain nothing but sophistry and illusion.
AN INQUIRY INTO THE HUMAN MIND

ON THE PRINCIPLES OF COMMON SENSE

THOMAS REID
CHAPTER 5,
SECTION VII

“OF THE EXISTENCE
OF A MATERIAL WORLD”

It is beyond our power to say, when or in what order we came by our notions of these qualities. When we trace the operations of our minds as far back as memory and reflection can carry us, we find them already in possession of our imagination and belief, and quite familiar to the mind: but how they came first into its acquaintance, or what has given them so strong a hold of our belief, and what regard they deserve, are no doubt very important questions in the philosophy of human nature.

Shall we, with the Bishop of Cloyne, serve them with *Quo warranto*, and have them tried at the bar of philosophy, upon the statute of the ideal system? Indeed, in this trial they seem to have come off very pitifully. For although they had very able counsel, learned in the law, *viz.* Descartes, Malebranche, and Locke, who said everything they could for their clients; the Bishop of Cloyne, believing them to be aiders and abettors of heresy and schism, prosecuted them with great vigour, fully answered all that had been pleaded in their defence, and silenced their ablest advocates, who seem for half a century past to decline the argument, and to trust to the favour of the jury rather than to the strength of their pleadings.

1 By what warrant?
Thus, the wisdom of *philosophy* is set in opposition to the *common sense* of mankind. The first pretends to demonstrate, *a priori*, that there can be no such thing as a material world; that sun, moon, stars, and earth, vegetable and animal bodies, are, and can be nothing else, but sensations in the mind, or images of those sensations in the memory and imagination; that, like pain and joy, they can have no existence when they are not thought of. The last can conceive no otherwise of this opinion, than as a kind of metaphysical lunacy; and concludes, that too much learning is apt to make men mad; and that the man who seriously entertains this belief, though in other respects he may be a very good man, as a man may be who believes that he is made of glass; yet surely he hath a soft place in his understanding, and hath been hurt by much thinking.

This opposition betwixt philosophy and common sense, is apt to have a very unhappy influence upon the philosopher himself. He sees human nature in an odd, unnamable, and mortifying light. He considers himself, and the rest of his species, as born under a necessity of believing ten thousand absurdities and contradictions, and endowed with such a pittance of reason, as is just sufficient to make this unhappy discovery: and this is all the fruit of his profound speculations. Such notions of human nature tend to slacken every nerve of the soul, to put every noble purpose and sentiment out of countenance, and spread a melancholy gloom over the whole face of things.

If this is wisdom, let me be deluded with the vulgar. I find something within me that recoils against it, and inspires more reverent sentiments of the human kind, and of the universal administration. Common sense and reason have both one author; that Almighty author, in all whose other works we observe a consistency, uniformity, and beauty, which charm and delight the understanding: there must therefore be some order and consistency in the human faculties, as well as in other parts of his workmanship. A man that thinks reverently of his own kind, and esteems true wisdom and philosophy, will not be found, nay, will be very suspicious, of such strange and paradoxical opinions. If they are false, they disgrace philosophy; and if they are true, they degrade the human species, and make us justly ashamed of our frame.
To what purpose is it for philosophy to decide against common sense in this or any other matter? The belief of a material world is older, and of more authority, than any principles of philosophy. It declines the tribunal of reason, and laughs at all the artillery of the logician. It retains its sovereign authority in spite of all the edicts of philosophy, and reason itself must stoop to its orders. Even those philosophers who have disowned the authority of our notions of an external material world, confess, that they find themselves under a necessity of submitting to their power.

Methinks, therefore, it were better to make a virtue of necessity; and, since we cannot get rid of the vulgar notion and belief of an external world, to reconcile our reason to it as well as we can: for if Reason should stomach and fret ever so much at this yoke, she cannot throw it off; if she will not be the servant of Common Sense, she must be her slave.

In order, therefore, to reconcile reason to common sense in this matter, I beg leave to offer to the consideration of philosophers these two observations. First, That in all this debate about the existence of a material world, it hath been taken for granted on both sides, that this same material world, if any such there be, must be the express image of our sensations; that we can have no conception of any material thing which is not like some sensation in our minds; and particularly, that the sensations of touch are images of extension, hardness, figure, and motion. Every argument brought against the existence of a material world, either by the Bishop of Cloyne, or by the author of the *Treatise of Human Nature*, supposeth this. If this is true, their arguments are conclusive and unanswerable: but, on the other hand, if it is not true, there is no shadow of argument left. Have those philosophers, then, given any solid proof of this hypothesis, upon which the whole weight of so strange a system rests? No. They have not so much as attempted to do it. But, because ancient and modern philosophers have agreed in this opinion, they have taken it for granted. But let us, as becomes philosophers, lay aside authority; we need not surely consult Aristotle or Locke, to know whether pain be like the point of a sword. I have as clear a conception of extension, hardness, and motion, as I have of the point of a sword;
and, with some pains and practice, I can form as clear a notion of
the other sensations of touch, as I have of pain. When I do so, and
compare them together, it appears to me clear as daylight, that the
former are not of kin to the latter, nor resemble them in any one
feature. They are as unlike, yea as certainly and manifestly unlike, as
pain is to the point of a sword. It may be true, that those sensations
first introduced the material world to our acquaintance ; it may be
true, that it seldom or never appears without their company ; but, for
all that, they are as unlike as the passion of anger is to those features
of the countenance which attend it.

So that, in the sentence those philosophers have passed against
the material world, there is an *error personae*\(^2\). Their proof touches not
matter, or any of its qualities ; but strikes directly against an idol of
their own imagination, a material world made of ideas and sensations,
which never had nor can have an existence.

Secondly, The very existence of our conceptions of extension,
figure, and motion, since they are neither ideas of sensation nor
reflection, overturns the whole ideal system, by which the material
world hath been tried and condemned : so that there hath been
likewise in this sentence an *error juris*.

It is a very fine and a just observation of Locke, That as no human
art can create a single particle of matter, and the whole extent of our
power over the material world, consists in compounding, combin-
ing, and disjoining, the matter made to our hands ; so in the world
of thought, the materials are all made by nature, and can only be
variously combined and disjoined by us. So that it is impossible for
reason or prejudice, true or false philosophy, to produce one simple
notion or conception, which is not the work of nature, and the result
of our constitution. The conception of extension, motion, and the
other attributes of matter, cannot be the effect of error or prejudice ;
it must be the work of nature. And the power or faculty, by which we
acquire those conceptions, must be something different from any
power of the human mind that hath been explained, since it is neither
sensation nor reflection.

\(^2\) Error of the person, error in mistaken identity.
Thus I would therefore humbly propose, as an *experimentum crucis*, by which the ideal system must stand or fall; and it brings the matter to a short issue: Extension, figure, motion, may, any one, or all of them, be taken for the subject of this experiment. Either they are ideas of sensation, or they are not. If any one of them can be shown to be an idea of sensation, or to have the least resemblance to any sensation, I lay my hand upon my mouth, and give up all pretence to reconcile reason to common sense in this matter, and must suffer the ideal scepticism to triumph. But if, on the other hand, they are not ideas of sensation, nor like to any sensation, then the ideal system is a rope of sand, and all the laboured arguments of the sceptical philosophy against a material world, and against the existence of everything but impressions and ideas, proceed upon a false hypothesis.

If our philosophy concerning the mind be so lame with regard to the origin of our notions of the clearest, most simple, and most familiar objects of thought and the powers from which they are derived, can we expect that it should be more perfect in the account it gives of the origin of our opinions and belief? We have seen already some instances of its imperfection in this respect: and perhaps that same nature which hath given us the power to conceive things altogether unlike to any of our sensations, or to any operation of our minds, hath likewise provided for our belief of them, by some part of our constitution hitherto not explained.

Bishop Berkeley hath proved, beyond the possibility of reply, that we cannot by reasoning infer the existence of matter from our sensations: and the author of the *Treatise of Human Nature* hath proved no less clearly, that we cannot by reasoning infer the existence of our own or other minds from our sensations. But are we to admit nothing but what can be proved by reasoning? Then we must be sceptics indeed, and believe nothing at all. The author of the *Treatise of Human Nature* appears to me to be but a half sceptic. He hath not followed his principles so far as they lead him: but after having, with

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3 Critical experiment. An *experimentum crucis* is an experiment capable of decisively determining whether or not a a theory is superior to all other theories currently held at large by the scientific community.
unparalleled intrepidity and success, combated vulgar prejudices; when he had but one blow to strike, his courage fails him, he fairly lays down his arms, and yields himself a captive to the most common of all vulgar prejudices, I mean the belief of the existence of his own impressions and ideas.

I beg, therefore, to have the honour of making an addition to the sceptical system, without which, I conceive, it cannot hang together. I affirm, that the belief of the existence of impressions and ideas, is as little supported by reason, as that of the existence of minds and bodies. No man ever did, or could offer any reason for this belief. Descartes took it for granted, that he thought, and had sensations and ideas; so have all his followers done. Even the hero of scepticism hath yielded this point, I crave leave to say, weakly and imprudently. I say so, because I am persuaded that there is no principle of his philosophy that obliged him to make this concession. And what is there in impressions and ideas so formidable, that this all-conquering philosophy, after triumphing over every other existence, should pay homage to them? Besides, the concession is dangerous: for belief is of such a nature, that if you leave any root, it will spread; and you may more easily pull it up altogether, than say, Hitherto shalt thou go, and no further: the existence of impressions and ideas I give up to thee; but see thou pretend to nothing more. A thorough and consistent sceptic will never, therefore, yield this point; and while he holds it, you can never oblige him to yield anything else.

To such a sceptic I have nothing to say; but of the semi-sceptics, I should beg leave to know, why they believe the existence of their impressions and ideas. The true reason I take to be, because they cannot help it; and the same reason will lead them to believe many other things.

All reasoning must be from first principles; and for first principles no other reason can be given but this, that, by the constitution of our nature, we are under a necessity of assenting to them. Such principles are parts of our constitution, no less than the power of thinking: reason can neither make nor destroy them; nor can it do anything without them: it is like a telescope, which may help a man to see farther, who hath eyes; but without eyes, a telescope shows
nothing at all. A mathematician cannot prove the truth of his axioms, nor can he prove anything, unless he takes them for granted. We cannot prove the existence of our minds, nor even of our thoughts and sensations. A historian, or a witness, can prove nothing, unless it is taken for granted that the memory and senses may be trusted. A natural philosopher can prove nothing, unless it is taken for granted that the course of nature is steady and uniform.

How or when I got such first principles, upon which I build all my reasoning, I know not; for I had them before I can remember: but I am sure they are parts of my constitution, and that I cannot throw them off. That our thoughts and sensations must have a subject, which we call ourselves, is not therefore an opinion got by reasoning, but a natural principle. That our sensations of touch indicate something external, extended, figured, hard or soft, is not a deduction of reason, but a natural principle. The belief of it, and the very conception of it, are equally parts of our constitution. If we are deceived in it, we are deceived by Him that made us, and there is no remedy.

I do not mean to affirm, that the sensations of touch do from the very first suggest the same notions of body and its qualities, which they do when we are grown up. Perhaps nature is frugal in this, as in her other operations. The passion of love, with all its concomitant sentiments and desires, is naturally suggested by the perception of beauty in the other sex. Yet the same perception does not suggest the tender passion, till a certain period of life. A blow given to an infant, raises grief and lamentation; but when he grows up, it as naturally stirs resentment, and prompts him to resistance. Perhaps a child in the womb, or for some short period of its existence, is merely a sentient being: the faculties, by which it perceives an external world, by which it reflects on its own thoughts, and existence, and relation to other things, as well as its reasoning and moral faculties, unfold themselves by degrees; so that it is inspired with the various principles of common sense, as with the passions of love and resentment, when it has occasion for them.
CHAPTER 5,  
SECTION VIII  

“OF THE SYSTEMS OF PHILOSOPHERS  
CONCERNING THE SENSES”

All the systems of philosophers about our senses and their objects have split upon this rock, of not distinguishing properly sensations, which can have no existence but when they are felt, from the things suggested by them. Aristotle, with as distinguishing a head as ever applied to philosophical disquisitions, confounds these two; and makes every sensation to be the form, without the matter, of the thing perceived by it: As the impression of a seal upon wax has the form of the seal, but nothing of the matter of it; so he conceived our sensations to be impressions upon the mind, which bear the image, likeness, or form of the external thing perceived, without the matter of it. Colour, sound, and smell, as well as extension, figure, and hardness, are, according to him, various forms of matter: our sensations are the same forms imprinted on the mind, and perceived in its own intellect.

It is evident from this, that Aristotle made no distinction between primary and secondary qualities of bodies, although that distinction was made by Democritus, Epicurus, and others of the ancients.

Descartes, Malebranche, and Locke, revived the distinction between primary and secondary qualities. But they made the secondary qualities mere sensations, and the primary ones resemblances of our sensations. They maintained, that colour, sound, and heat, are not anything in bodies, but sensations of the mind: at the same time, they
acknowledged some particular texture or modification of the body, to be the cause or occasion of those sensations; but to this modification they gave no name. Whereas, by the vulgar, the names of colour, heat, and sound, are but rarely applied to the sensations, and most commonly to those unknown causes of them; as hath been already explained. The constitution of our nature leads us rather to attend to the things signified by the sensation, than to the sensation itself, and to give a name to the former rather than to the latter. Thus we see, that with regard to secondary qualities, these philosophers thought with the vulgar, and with common sense. Their paradoxes were only an abuse of words. For when they maintain, as an important modern discovery, that there is no heat in the fire, they mean no more, than that the fire does not feel heat, which everyone knew before.

With regard to primary qualities, these philosophers erred most grossly: They indeed believed the existence of those qualities; but they did not at all attend to the sensations that suggest them, which having no names, have been as little considered as if they had no existence. They were aware, that figure, extension, and hardness, are perceived by means of sensations of touch; whence they rashly concluded, that these sensations must be images and resemblances of figure, extension, and hardness.

The received hypothesis of ideas naturally led them to this conclusion; and indeed cannot consist with any other; for, according to that hypothesis, external things must be perceived by means of images of them in the mind; and what can those images of external things in the mind be, but the sensations by which we perceive them?

This however was to draw a conclusion from an hypothesis against fact. We need not have recourse to any hypothesis to know what our sensations are, or what they are like. By a proper degree of reflection and attention, we may understand them perfectly, and be as certain that they are not like any quality of body, as we can be, that the tooth-ache is not like a triangle. How a sensation should instantly make us conceive and believe the existence of an external thing altogether unlike to it, I do not pretend to know; and when I say that the one suggests the other, I mean not to explain the manner of their connection, but to express a fact, which every one may be conscious of;
namely, that, by a law of our nature, such a conception and belief constantly and immediately follow the sensation.

Bishop Berkeley gave new light to this subject, by showing, that the qualities of an inanimate thing, such as matter is conceived to be, cannot resemble any sensation; that it is impossible to conceive anything like the sensations of our minds, but the sensations of other minds. Every one that attends properly to these sensations must assent to this; yet it had escaped all the philosophers that came before Berkeley; it had escaped even the ingenious Locke, who had so much practised reflection on the operations of his own mind. So difficult it is to attend properly even to our own feelings. They are so accustomed to pass through the mind unobserved, and instantly to make way for that which nature intended them to signify, that it is extremely difficult to stop, and survey them; and when we think we have acquired this power, perhaps the mind still fluctuates between the sensation and its associated quality, so that they mix together, and present something to the imagination that is compounded of both. Thus in a globe or cylinder, whose opposite sides are quite unlike in colour, if you turn it slowly, the colours are perfectly distinguishable, and their dissimilitude is manifest; but if it is turned fast, they lose their distinction, and seem to be of one and the same colour.

No succession can be more quick, than that of tangible qualities to the sensations with which nature has associated them: But when one has once acquired the art of making them separate and distinct objects of thought, he will then clearly perceive, that the maxim of Bishop Berkeley above mentioned, is self-evident; and that the features of the face are not more unlike to a passion of the mind which they indicate, than the sensations of touch are to the primary qualities of body.

But let us observe what use the Bishop makes of this important discovery: Why, he concludes, that we can have no conception of an inanimate substance, such as matter is conceived to be, or of any of its qualities; and that there is the strongest ground to believe that there is no existence in nature but minds, sensations, and ideas: If there is any other kind of existence, it must be what we neither have nor can have any conception of. But how does this follow? Why thus: We can have no conception of anything but what resembles
some sensation or idea in our minds; but the sensations and ideas in our minds can resemble nothing but the sensations and ideas in other minds; therefore, the conclusion is evident. This argument, we see, leans upon two propositions. The last of them the ingenious author hath indeed made evident to all that understand his reasoning, and can attend to their own sensations: but the first proposition he never attempts to prove; it is taken from the doctrine of ideas, which hath been so universally received by philosophers, that it was thought to need no proof.

We may here again observe, that this acute writer argues from a hypothesis against fact, and against the common sense of mankind. That we can have no conception of anything, unless there is some impression, sensation, or idea, in our minds which resembles it, is indeed an opinion which hath been very generally received among philosophers; but it is neither self-evident, nor hath it been clearly proved: and therefore it had been more reasonable to call in question this doctrine of philosophers, than to discard the material world, and by that means expose philosophy to the ridicule of all men, who will not offer up common sense as a sacrifice to metaphysics.

We ought, however, to do this justice both to the Bishop of Cloyne and to the author of the Treatise of Human Nature, to acknowledge, that their conclusions are justly drawn from the doctrine of ideas, which has been so universally received. On the other hand, from the character of Bishop Berkeley, and of his predecessors Descartes, Locke, and Malebranche, we may venture to say, that if they had seen all the consequences of this doctrine, as clearly as the author before mentioned did, they would have suspected it vehemently, and examined it more carefully than they appear to have done.

The theory of ideas, like the Trojan horse, had a specious appearance both of innocence and beauty; but if those philosophers had known that it carried in its belly death and destruction to all science and common sense, they would not have broken down their walls to give it admittance.

That we have clear and distinct conceptions of extension, figure, motion, and other attributes of body, which are neither sensations, nor like any sensation, is a fact of which we may be as certain, as that
we have sensations. And that all mankind have a fixed belief of an external material world, a belief which is neither got by reasoning nor education, and a belief which we cannot shake off, even when we seem to have strong arguments against it, and no shadow of argument for it, is likewise a fact, for which we have all the evidence that the nature of the thing admits. These facts are phenomena of human nature, from which we may justly argue against any hypothesis, however generally received. But to argue from a hypothesis against facts, is contrary to the rules of true philosophy.
Sensation, and the perception of external objects by the senses, though very different in their nature, have commonly been considered as one and the same thing. The purposes of common life do not make it necessary to distinguish them, and the received opinions of philosophers tend rather to confound them; but, without attending carefully to this distinction, it is impossible to have any just conception of the operations of our senses. The most simple operations of the mind, admit not of a logical definition: all we can do is to describe them, so as to lead those who are conscious of them in themselves, to attend to them, and reflect upon them: and it is often very difficult to describe them so as to answer this intention.

The same mode of expression is used to denote sensation and perception; and therefore we are apt to look upon them as things of the same nature. Thus, I feel a pain; I see a tree: the first denoteth a sensation, the last a perception. The grammatical analysis of both expressions is the same: for both consist of an active verb and an object. But, if we attend to the things signified by these expressions, we shall find, that in the first, the distinction between the act and the object is not real but grammatical; in the second, the distinction is not only grammatical but real.

The form of the expression, I feel pain, might seem to imply, that the feeling is something distinct from the pain felt; yet in reality, there is no distinction. As thinking a thought is an expression which could
signify no more than *thinking*, so *feeling a pain* signifies no more than being *pained*. What we have said of pain is applicable to every other mere sensation. It is difficult to give instances, very few of our sensations having names; and where they have, the name being common to the sensation, and to something else which is associated with it. But when we attend to the sensation by itself, and separate it from other things which are conjoined with it in the imagination, it appears to be something which can have no existence but in a sentient mind, no distinction from the act of the mind by which it is felt.

Perception, as we here understand it, hath always an object distinct from the act by which it is perceived; an object which may exist whether it be perceived or not. I perceive a tree that grows before my window; there is here an object which is perceived; and an act of the mind by which it is perceived, and these two are not only distinguishable, but they are extremely unlike in their natures. The object is made up of a trunk, branches, and leaves; but the act of the mind, by which it is perceived, hath neither trunk, branches, nor leaves. I am conscious of this act of my mind, and I can reflect upon it; but it is too simple to admit of an analysis, and I cannot find proper words to describe it. I find nothing that resembles it so much as the remembrance of the tree, or the imagination of it. Yet both these differ essentially from perception; they differ likewise one from another. It is in vain that a philosopher assures me, that the imagination of the tree, the remembrance of it, and the perception of it, are all one, and differ only in degree of vivacity. I know the contrary; for I am as well acquainted with all the three, as I am with the apartments of my own house. I know this also, that the perception of an object implies both a conception of its form, and a belief of its present existence. I know, moreover, that this belief is not the effect of argumentation and reasoning; it is the immediate effect of my constitution.

I am aware, that this belief which I have in perception, stands exposed to the strongest batteries of scepticism. But they make no great impression upon it. The sceptic asks me, Why do you believe the existence of the external object which you perceive? This belief, Sir, is none of my manufacture; it came from the mint of nature; it bears her image and superscription; and, if it is not right, the fault is
not mine: I even took it upon trust, and without suspicion. Reason, says the sceptic, is the only judge of truth, and you ought to throw off every opinion and every belief that is not grounded on reason. Why, Sir, should I believe the faculty of reason more than that of perception; they came both out of the same shop, and were made by the same artist; and if he puts one piece of false ware into my hands, what should hinder him from putting another?

Perhaps the sceptic will agree to distrust reason, rather than give any credit to perception. For, says he, since, by your own concession, the object which you perceive, and that act of your mind, by which you perceive it, are quite different things, the one may exist without the other; and as the object may exist without being perceived, so the perception may exist without an object. There is nothing so shameful in a philosopher as to be deceived and deluded; and therefore you ought to resolve firmly to withhold assent, and to throw off this belief of external objects, which may be all delusion. For my part, I will never attempt to throw it off; and although the sober part of mankind will not be very anxious to know my reasons, yet if they can be of use to any sceptic, they are these.

First, Because it is not in my power: why then should I make a vain attempt? It would be agreeable to fly to the moon, and to make a visit to Jupiter and Saturn; but when I know that nature has bound me down by the law of gravitation to this planet which I inhabit, I rest contented, and quietly suffer myself to be carried along in its orbit. My belief is carried along by perception, as irresistibly as my body by the earth. And the greatest sceptic will find himself to be in the same condition. He may struggle hard to disbelieve the informations of his senses, as a man does to swim against a torrent; but ah! it is in vain. It is in vain that he strains every nerve, and wrestles with nature, and with every object that strikes upon his senses. For after all, when his strength is spent in the fruitless attempt, he will be carried down the torrent with the common herd of believers.

Secondly, I think it would not be prudent to throw off this belief, if it were in my power. If nature intended to deceive me, and impose upon me by false appearances, and I, by my great cunning and profound logic, have discovered the imposture; prudence would dictate to me
in this case, even to put up this indignity done me, as quietly as I could, and not to call her an impostor to her face, lest she should be even with me in another way. For what do I gain by resenting this injury? You ought at least not to believe what she says. This indeed seems reasonable, if she intends to impose upon me. But what is the consequence? I resolve not to believe my senses. I break my nose against a post that comes in my way; I step into a dirty kennel; and, after twenty such wise and rational actions, I am taken up and clapped into a mad-house. Now, I confess I would rather make one of the credulous fools whom nature imposes upon, than of those wise and rational philosophers who resolve to withhold assent at all this expense. If a man pretends to be a sceptic with regard to the informations of sense, and yet prudently keeps out of harm’s way as other men do, he must excuse my suspicion, that he either acts the hypocrite, or imposes upon himself. For if the scale of his belief were so evenly poised, as to lean no more on one side than to the contrary, it is impossible that his actions could be directed by any rules of common prudence.

Thirdly, Although the two reasons already mentioned are perhaps two more than enough, I shall offer a third. I gave implicit belief to the informations of nature by my senses, for a considerable part of my life, before I had learned so much logic as to be able to start a doubt concerning them. And now, when I reflect upon what is past, I do not find that I have been imposed upon by this belief. I find, that without it I must have perished by a thousand accidents. I find, that without it I should have been no wiser now than when I was born. I should not even have been able to acquire that logic which suggests these sceptical doubts with regard to my senses. Therefore, I consider this instinctive belief as one of the best gifts of nature. I thank the Author of my being who bestowed it upon me, before the eyes of my reason were opened, and still bestows it upon me to be my guide, where reason leaves me in the dark. And now I yield to the direction of my senses, not from instinct only, but from confidence and trust in a faithful and beneficent Monitor, grounded upon the experience of his paternal care and goodness.

In all this, I deal with the Author of my being, no otherwise than I thought it reasonable to deal with my parents and tutors. I believed
by instinct whatever they told me, long before I had the idea of a lie, or thought of the possibility of their deceiving me. Afterwards, upon reflection, I found they had acted like fair and honest people who wished me well. I found, that if I had not believed what they told me, before I could give a reason of my belief, I had to this day been little better than a changeling. And although this natural credulity hath sometimes occasioned my being imposed upon by deceivers, yet it hath been of infinite advantage to me upon the whole; therefore I consider it as another good gift of nature. And I continue to give that credit, from reflection, to those of whose integrity and veracity I have had experience, which before I gave from instinct.

There is a much greater similitude than is commonly imagined, between the testimony of nature given by our senses, and the testimony of men given by language. The credit we give to both is at first the effect of instinct only. When we grow up, and begin to reason about them, the credit given to human testimony is restrained, and weakened, by the experience we have of deceit. But the credit given to the testimony of our senses, is established and confirmed by the uniformity and constancy of the laws of nature.

Our perceptions are of two kinds: some are natural and original, others acquired, and the fruit of experience. When I perceive that this is the taste of cyder, that of brandy; that this is the smell of an apple, that of an orange; that this is the noise of thunder, that the ringing of bells; this the sound of a coach passing, that the voice of such a friend; these perceptions, and others of the same kind, are not original, they are acquired. But the perception which I have by touch, of the hardness and softness of bodies, of their extension, figure, and motion, is not acquired; it is original.

In all our senses, the acquired perceptions are many more than the original, especially in sight. By this sense we perceive originally the visible figure and colour of bodies only, and their visible place: but we learn to perceive by the eye, almost everything which we can perceive by touch. The original perceptions of this sense, serve only as signs to introduce the acquired.

The signs by which objects are presented to us in perception, are the language of nature to man; and as, in many respects, it hath great
affinity with the language of man to man; so particularly in this, that both are partly natural and original, partly acquired by custom. Our original or natural perceptions are analogous to the natural language of man to man, of which we took notice in the 4th chapter; and our acquired perceptions are analogous to artificial language, which, in our mother-tongue, is got very much in the same manner with our acquired perceptions, as we shall afterwards more fully explain.

Not only men, but children, idiots, and brutes, acquire by habit many perceptions which they had not originally. Almost every employment in life, hath perceptions of this kind that are peculiar to it. The shepherd knows every sheep of his flock, as we do our acquaintance, and can pick them out of another flock one by one. The butcher knows by sight the weight and quality of his beeves and sheep before they are killed. The farmer perceives by his eye, very nearly, the quantity of hay in a rick, or of corn in a heap. The sailor sees the burden, the build, and the distance of a ship at sea, while she is a great way off. Every man accustomed to writing, distinguishes his acquaintance by their handwriting, as he does by their faces. And the painter distinguishes in the works of his art, the style of all the great masters. In a word, acquired perception is very different in different persons, according to the diversity of objects about which they are employed, and the application they bestow in observing them.

Perception ought not only to be distinguished from sensation, but likewise from that knowledge of the objects of sense which is got by reasoning. There is no reasoning in perception, as hath been observed. The belief which is implied in it, is the effect of instinct. But there are many things, with regard to sensible objects, which we can infer from what we perceive; and such conclusions of reason ought to be distinguished from what is merely perceived. When I look at the moon, I perceive her to be sometimes circular, sometimes horned, and sometimes gibbous. This is simple perception, and is the same in the philosopher, and in the clown: but from these various appearances of her enlightened part, I infer that she is really of a spherical figure. This conclusion is not obtained by simple perception, but by reasoning. Simple perception has the same relation to the conclusions of reason drawn from our perceptions, as the axioms in mathematics
have to the propositions. I cannot demonstrate, that two quantities which are equal to the same quantity, are equal to each other; neither can I demonstrate, that the tree which I perceive, exists. But, by the constitution of my nature, my belief is irresistibly carried along by my apprehension of the axiom; and by the constitution of my nature, my belief is no less irresistibly carried along by my perception of the tree. All reasoning is from principles. The first principles of mathematical reasoning are mathematical axioms and definitions; and the first principles of all our reasoning about existences, are our perceptions. The first principles of every kind of reasoning are given us by nature, and are of equal authority with the faculty of reason itself, which is also the gift of nature. The conclusions of reason are all built upon first principles, and can have no other foundation. Most justly, therefore, do such principles disdain to be tried by reason, and laugh at all the artillery of the logician, when it is directed against them.

When a long train of reasoning is necessary in demonstrating a mathematical proposition, it is easily distinguished from an axiom, and they seem to be things of a very different nature. But there are some propositions which lie so near to axioms, that it is difficult to say, whether they ought to be held as axioms, or demonstrated as propositions. The same thing holds with regard to perception, and the conclusions drawn from it. Some of these conclusions follow our perceptions so easily, and are so immediately connected with them, that it is difficult to fix the limit which divides the one from the other.

Perception, whether original or acquired, implies no exercise of reason; and is common to men, children, idiots, and brutes. The more obvious conclusions drawn from our perceptions, by reason, make what we call common understanding; by which men conduct themselves in the common affairs of life, and by which they are distinguished from idiots. The more remote conclusions which are drawn from our perceptions, by reason, make what we commonly call science in the various parts of nature, whether in agriculture, medicine, mechanics, or in any part of natural philosophy. When I see a garden in good order, containing a great variety of things of the best kinds, and in the most flourishing condition, I immediately conclude from these signs, the skill and industry of the gardener. A farmer, when
he rises in the morning, and perceives that the neighbouring brook overflows his field, concludes that a great deal of rain hath fallen in the night. Perceiving his fence broken, and his corn trodden down, he concludes that some of his own or his neighbours cattle have broken loose. Perceiving that his stable-door is broken open, and some of his horses gone, he concludes that a thief has carried them off. He traces the prints of his horses feet in the soft ground, and by them discovers which road the thief hath taken. These are instances of common understanding, which dwells so near to perception, that it is difficult to trace the line which divides the one from the other. In like manner, the science of nature dwells so near to common understanding, that we cannot discern where the latter ends and the former begins. I perceive that bodies, lighter than water, swim in water, and that those which are heavier sink. Hence I conclude, that if a body remains wherever it is put under water, whether at the top or bottom, it is precisely of the same weight with water. If it will rest only when part of it is above water, it is lighter than water. And the greater the part above water is, compared with the whole, the lighter is the body. If it had no gravity at all, it would make no impression upon the water, but stand wholly above it. Thus, every man, by common understanding, has a rule by which he judges of the specific gravity of bodies which swim in water: and a step or two more leads him into the science of hydrostatics.

All that we know of nature, or of existences, may be compared to a tree, which hath its root, trunk, and branches. In this tree of knowledge, perception is the root, common understanding is the trunk, and the sciences are the branches.