THE

ENGLISH WORKS

OF

THOMAS HOBBES

OF MALMESBURY;

NOW FIRST COLLECTED AND EDITED

BY

SIR WILLIAM MOLESWORTH, BART.

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SCIENTIA AALEN

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DEDICATION.

faction to be able to gratify a wish, you have frequently expressed, that some person, who had time and due reverence for that illustrious man, would undertake to edite his works, and bring his views again before his countrymen, who have so long and so unjustly neglected him. And likewise, I am desirous, in some way, to express the sincere regard and respect that I feel for you, and the gratitude that I owe you for the valuable instruction, that I have obtained from your society, and from the friendship with which you have honoured me, during the many years we have been companions in political life.

Yours, truly,

William Molesworth.

February 25th, 1839.

ELEMENTS OF PHILOSOPHY.

THE FIRST SECTION,

CONCERNING BODY,

WRITTEN IN LATIN

BY

THOMAS HOBBES OF MALMESBURY,

AND

TRANSLATED INTO ENGLISH.
one another like situation with the points E, F, and G, or are placed alike; which was to be proved.

**Figure is quantity, determined by the situation or placing of all its extreme points.** Now I call those points extreme, which are contiguous to the place which is without the figure. In lines therefore and superficies, all points may be called extreme; but in solids only those which are in the superficies that includes them.

*Like figures* are those, whose extreme points in one of them are all placed like all the extreme points in the other; for such figures differ in nothing but magnitude.

And like figures are *alike placed*, when in both of them the homologal strait lines, that is, the strait lines which connect the points which answer one another, are parallel, and have their proportional sides inclined the same way.

And seeing every strait line is like every other strait line, and every plane like every other plane, when nothing but planeness is considered; if the lines, which include planes, or the superficies, which include solids, have their proportions known, it will not be hard to know whether any figure be like or unlike to another propounded figure.

And thus much concerning the *first grounds of philosophy*. The next place belongs to *geometry*; in which the quantities of figures are sought out from the proportions of lines and angles. Wherefore it is necessary for him, that would study geometry, to know first what is the nature of quantity, proportion, angle and figure. Having therefore explained these in the three last chapters, I thought fit to add them to this part; and so pass to the next.
be thrust together within the narrow limits of this discourse, I thought fit to admonish the reader, that before he proceed further, he take into his hands the works of Euclid, Archimedes, Apollonius, and other as well ancient as modern writers. For to what end is it, to do over again that which is already done? The little therefore that I shall say concerning geometry in some of the following chapters, shall be such only as is new, and conducing to natural philosophy.

I have already delivered some of the principles of this doctrine in the eighth and ninth chapters; which I shall briefly put together here, that the reader in going on may have their light nearer at hand.

First, therefore, in chap. viii. art. 10, motion is defined to be the continual privation of one place, and acquisition of another.

Secondly, it is there shown, that whatsoever is moved is moved in time.

Thirdly, in the same chapter, art. 11, I have defined rest to be when a body remains for some time in one place.

Fourthly, it is there shown, that whatsoever is moved is not in any determined place; as also that the same has been moved, is still moved, and will yet be moved; so that in every part of that space, in which motion is made, we may consider three times, namely, the past, the present, and the future time.

Fifthly, in art. 15 of the same chapter, I have defined velocity or swiftness to be motion considered as power, namely, that power by which a body moved may in a certain time transmit a certain length; which also may more briefly be enunciated thus, velocity is the quantity of motion determined by time and line.

Sixthly, in the same chapter, art. 16, I have shown that motion is the measure of time.

Seventhly, in the same chapter, art. 17, I have defined motions to be equally swift, when in equal times equal lengths are transmitted by them.

Eighthly, in art. 18 of the same chapter, motions are defined to be equal, when the swiftness of one moved body, computed in every part of its magnitude, is equal to the swiftness of another, computed also in every part of its magnitude. From whence it is to be noted, that motions equal to one another, and motions equally swift, do not signify the same thing; for when two horses draw abreast, the motion of both is greater than the motion of either of them singly; but the swiftness of both together is but equal to that of either.

Ninthly, in art. 19 of the same chapter, I have shown, that whatsoever is at rest will always be at rest, unless there be some other body besides it, which by getting into its place suffers it no longer to remain at rest. And that whatsoever is moved, will always be moved, unless there be some other body besides it, which hinders its motion.

Tenthly, in chap. ix. art. 7, I have demonstrated, that when any body is moved which was formerly at rest, the immediate efficient cause of that motion is in some other moved and contiguous body.

Eleventhly, I have shown in the same place, that whatsoever is moved, will always be moved in the same way, and with the same swiftness, if it be
not hindered by some other moved and contiguous body.

2. To which principles I shall here add those that follow. First, I define _endeavour_ to be motion made in less space and time than can be given; that is, less than can be determined or assigned by exposition or number; that is, motion made through the length of a point, and in an instant or point of time. For the explaining of which definition it must be remembered, that by a point is not to be understood that which has no quantity, or which cannot by any means be divided; for there is no such thing in nature; but that, whose quantity is not at all considered, that is, whereof neither quantity nor any part is computed in demonstration; so that a point is not to be taken for an indivisible, but for an undivided thing; as also an instant is to be taken for an undivided, and not for an indivisible time.

In like manner, _endeavour_ is to be conceived as motion; but so as that neither the quantity of the time in which, nor of the line in which it is made, may in demonstration be at all brought into comparison with the quantity of that time, or of that line of which it is a part. And yet, as a point may be compared with a point, so one _endeavour_ may be compared with another _endeavour_, and one may be found to be greater or less than another. For if the vertical points of two angles be compared, they will be equal or unequal in the same proportion which the angles themselves have to one another. Or if a straight line cut many circumferences of concentric circles, the inequality of the points of intersection will be in the same propor-

And in the same manner, if two motions begin and end both together, their _endeavours_ will be equal or unequal, according to the proportion of their velocities; as we see a bullet of lead descend with greater _endeavour_ than a ball of wool.

Secondly, I define _impetus_, or quickness of motion, to be the swiftness or velocity of the body moved, but considered in the several points of that time in which it is moted. In which sense _impetus_ is nothing else but the quantity or velocity of _endeavour_. But considered with the whole time, it is the whole velocity of the body moved taken together throughout all the time, and equal to the product of a line representing the time, multiplied into a line representing the arithmetically mean _impetus_ or quickness. Which arithmetical mean, what it is, is defined in the 29th article of chapter XIII.

And because in equal times the ways that are passed are as the velocities, and the _impetus_ is the velocity they go withal, reckoned in all the several points of the times, it followeth that during any time whatsoever, howsoever the _impetus_ be increased or decreased, the length of the way passed over shall be increased or decreased in the same proportion; and the same line shall represent both the way of the body moved, and the several _impetus_ or degrees of swiftness wherewith the way is passed over.

And if the body moved he not a point, but a strait line moved so as that every point thereof make a several strait line, the plane described by its motion, whether uniform, accelerated, or re-
tarded, shall be greater or less, the time being the same, in the same proportion with that of the *impetus* reckoned in one motion to the *impetus* reckoned in the other. For the reason is the same in parallelograms and their sides.

For the same cause also, if the body moved be a plane, the solid described shall be still greater or less in the proportions of the several *impetus* or quicknesses reckoned through one line, to the several *impetus* reckoned through another.

This understood, let A B C D, (in figure 1, chap. xvii.) be a parallelogram; in which suppose the side A B to be moved parallelly to the opposite side C D, decreasing all the way till it vanish in the point C, and so describing the figure A B E F C; the point B, as A B decreases, will therefore describe the line B E F C; and suppose the time of this motion designed by the line C D; and in the same time C D, suppose the side A C to be moved parallelly and uniformly to B D. From the point O taken at adventure in the line C D, draw O R parallel to B D, cutting the line B E F C in E, and the side A B in R. And again, from the point Q taken also at adventure in the line C D, draw Q S parallel to B D, cutting the line B E F C in F, and the side A B in S; and draw E G and F H parallel to C D, cutting A C in G and H. Lastly, suppose the same construction done in all the points possible of the line B E F C. I say, that as the proportions of the swiftness wherewith Q F, O E, D B, and all the rest supposed to be drawn parallel to D B and terminated in the line B E F C, are to the proportions of their several times designed by the several parallels H F, G E, A B, and all the

rest supposed to be drawn parallel to the line of time C D and terminated in the line B E F C, the aggregate to the aggregate, so is the area or plane D B E F C to the area or plane A C F E B. For as A B decreasing continually by the line B E F C vanisheth in the time C D into the point C, so in the same time the line D C continually decreasing vanisheth by the same line C F E B into the point B; and the point D describeth in that decreasing motion the line D B equal to the line A C described by the point A in the decreasing motion of A B; and their swiftnesses are therefore equal. Again, because in the time G E the point O describeth the line O E, and in the same time the point S describeth the line S E, the line O E shall be to the line S E, as the swiftness wherewith O E is described to the swiftness wherewith S E is described. In like manner, because in the same time H F the point Q describeth the line Q F, and the point R the line R F, it shall be as the swiftness by which Q F is described to the swiftness by which R F is described, so the line itself Q F to the line itself R F; and so in all the lines that can possibly be drawn parallel to B D in the points where they cut the line B E F C. But all the parallels to B D, as S E, R F, A C, and the rest that can possibly be drawn from the line A B to the line B E F C, make the area of the plane A B E F C; and all the parallels to the same B D, as Q F, O E, D B and the rest drawn to the points where they cut the same line B E F C, make the area of the plane B E F C D. As therefore the aggregate of the swiftnesses wherewith the plane B E F C D is described, is to the aggregate of the swiftnesses wherewith
the plane $ACFB$ is described, so is the plane itself $BEFC$ to the plane itself $ACFB$. But the aggregate of the times represented by the parallels $AB$, $GE$, $HF$ and the rest, maketh also the area $ACFB$. And therefore, as the aggregate of all the lines $QF$, $OE$, $DB$ and all the rest of the lines parallel to $RD$ and terminated in the line $BEFC$, is to the aggregate of all the lines $HF$, $GE$, $AB$ and all the rest of the lines parallel to $CD$ and terminated in the same line $BEFC$; that is, as the aggregate of the lines of swiftness to the aggregate of the lines of time, or as the whole swiftness in the parallels to $DB$ to the whole time in the parallels to $CD$, so is the plane $BEFC$ to the plane $ACFB$. And the proportions of $QF$ to $FH$, and of $OE$ to $EG$, and of $DB$ to $BA$, and so of all the rest taken together, are the proportions of the plane $DBEFC$ to the plane $ABEFC$. But the lines $QF$, $OE$, $DB$ and the rest are the lines that design the swiftness: and the lines $HF$, $GE$, $AB$ and the rest are the lines that design the times of the motions; and therefore the proportion of the plane $DBEFC$ to the plane $ABEFC$ is the proportion of all the velocities taken together to all the times taken together. Wherefore, as the proportions of the swiftnesses, &c.; which was to be demonstrated.

The same holds also in the diminution of the circles, whereof the lines of time are the semidiameters, as may easily be conceived by imagining the whole plane $ABCD$ turned round upon the axis $BD$; for the line $BEFC$ will be everywhere in the superficies so made, and the lines $HF$, $GE$, $AB$, which are here parallelograms, will be there cylinders, the diameters of whose bases are the lines $HF$, $GE$, $AB$, &c. and the altitude a point, that is to say, a quantity less than any quantity that can possibly be named; and the lines $QF$, $OE$, $DB$, &c. small solids whose lengths and breadths are less than any quantity that can be named.

But this is to be noted, that unless the proportion of the sum of the swiftnesses to the proportion of the sum of the times be determined, the proportion of the figure $DBEFC$ to the figure $ABEFC$ cannot be determined.

Thirdly, I define resistance to be the endeavour of one moved body either wholly or in part contrary to the endeavour of another moved body, which toucheth the same. I say, wholly contrary, when the endeavour of two bodies proceeds in the same strait line from the opposite extremes, and contrary in part, when two bodies have their endeavour in two lines, which, proceeding from the extreme points of a strait line, meet without the same.

Fourthly, that I may define what it is to press, I say, that of two moved bodies one presses the other, when with its endeavour it makes either all or part of the other body to go out of its place.

Fifthly, a body, which is pressed and not wholly removed, is said to restore itself, when the pressing body being taken away, the parts which were moved do, by reason of the internal constitution of the pressed body, return every one into its own place. And this we may observe in springs, in blown bladders, and in many other bodies, whose parts yield more or less to the endeavour which the pressing body makes at the
first arrival; but afterwards, when the pressing body is removed, they do, by some force within them, restore themselves, and give their whole body the same figure it had before.

Sixthly, I define force to be the impetus or quickness of motion multiplied either into itself, or into the magnitude of the moment, by means whereof the said moment works more or less upon the body that resists it.

3. Having premised thus much, I shall now demonstrate, first, that if a point moved come to touch another point which is at rest, how little soever the impetus or quickness of its motion be, it shall move that other point. For if by that impetus it do not at all move it out of its place, neither shall it move it with double the same impetus. For nothing doubled is still nothing; and for the same reason it shall never move it with that impetus, how many times soever it be multiplied, because nothing, however it be multiplied, will for ever be nothing. Wherefore, when a point is at rest, if it do not yield to the least impetus, it will yield to none; and consequently it will be impossible that which is at rest, should ever be moved.

Secondly, that when a point moved, how little soever the impetus thereof be, falls upon a point of any body at rest, how hard soever that body be, it will at the first touch make it yield a little. For if it do not yield to the impetus which is in that point, neither will it yield to the impetus of never so many points, which have all their impetuses severally equal to the impetus of that point. For seeing all those points together work equally, if any one of them have no effect, the aggregate of them all together shall have no effect as many times told as there are points in the whole body, that is, still no effect at all; and by consequent there would be some bodiess so hard that it would be impossible to break them; that is, a finite hardness, or a finite force, would not yield to that which is infinite; which is absurd.

Coroll. It is therefore manifest, that rest does nothing at all, nor is of any efficacy; and that nothing but motion gives motion to such things as be at rest, and takes it from things moved.

Thirdly, that cessation in the moment does not cause cessation in that which was moved by it. For (by number 11 of art. 1 of this chapter) whatever is moved perseveres in the same way and with the same swiftness, as long as it is not hindered by something that is moved against it. Now it is manifest, that cessation is not contrary motion; and therefore it follows that the standing still of the moment does not make it necessary that the thing moved should also stand still.

Coroll. They are therefore deceived, that reckon the taking away of the impediment or resistance for one of the causes of motion.

4. Motion is brought into account for divers respects; first, as in a body undivided, that is, considered as a point; or, as in a divided body. In an undivided body, when we suppose the way, by which the motion is made, to be a line; and in a divided body, when we compute the motion of the several parts of that body, as of parts.

Secondly, from the diversity of the regulation of motion, it is in body, considered as undivided.
sometimes uniform and sometimes multiform. Uniform is that by which equal lines are always transmitted in equal times; and multiform, when in one time more, in another time less space is transmitted. Again, of multiform motions, there are some in which the degrees of acceleration and retardation proceed in the same proportions, which the spaces transmitted have, whether duplicate, or triplicate, or by whatsoever number multiplied; and others in which it is otherwise.

Thirdly, from the number of the movent; that is, one motion is made by one movent only, and another by the concourse of many movents.

Fourthly, from the position of that line in which a body is moved; in respect of some other line; and from hence one motion is called perpendicular, another oblique, another parallel.

Fifthly, from the position of the movent in respect of the moved body; from whence one motion is pulsion or driving, another traction or drawing. Pulsion, when the movent makes the moved body go before it; and traction, when it makes it follow. Again, there are two sorts of pulsion; one, when the motions of the movent and moved body begin both together, which may be called traction or thrusting and section; the other, when the movent is first moved, and afterwards the moved body, which motion is called percussion or stroke.

Sixthly, motion is considered sometimes from the effect only which the movent works in the moved body, which is usually called moment. Now moment is the excess of motion which the movent has above the motion or endeavour of the resisting body.

Seventhly, it may be considered from the diversity of the medium; as one motion may be made in vacuity or empty place; another in a fluid; another in a consistent medium, that is, a medium whose parts are by some power so consistent and cohering, that no part of the same will yield to the movent, unless the whole yield also.

Eighthly, when a moved body is considered as having parts, there arises another distinction of motion into simple and compound. Simple, when all the several parts describe several equal lines; compounded, when the lines described are unequal.

5. All endeavour tends towards that part, that is to say, in that way which is determined by the motion of the movent, if the movent be but one; or, if there be many movents, in that way which their concourse determines. For example, if a moved body have direct motion, its first endeavour will be in a cire, if it have circular motion, its first endeavour will be in the circumference of a circle.

6. And whatsoever the line be, in which a body has its motion from the concourse of two movents, as soon as in any point thereof the force of one of the movents ceases, there immediately the former endeavour of that body will be changed into an endeavour in the line of the other movent.

Wherefore, when any body is carried on by the concourse of two winds, one of those winds ceasing, the endeavour and motion of that body will be in that line, in which it would have been carried by that wind alone which blows still. And in the describing of a circle, where that which is moved has its motion determined by a movent in a
tangent, and by the radius which keeps it in a certain distance from the centre, if the retention of the radius cease, that endeavour, which was in the circumference of the circle, will now be in the tangent, that is, in a strait line. For, seeing endeavour is computed in a less part of the circumference than can be given, that is, in a point, the way by which a body is moved in the circumference is compounded of innumerable strait lines, of which every one is less than can be given; which are therefore called points. Wherefore when any body, which is moved in the circumference of a circle, is freed from the retention of the radius, it will proceed in one of those strait lines, that is, in a tangent.

7. All endeavour, whether strong or weak, is propagated to infinite distance; for it is motion. If therefore the first endeavour of a body be made in space which is empty, it will always proceed with the same velocity; for it cannot be supposed that it can receive any resistance at all from empty space; and therefore, (by art. 7, chap. 12) it will always proceed in the same way and with the same swiftness. And if its endeavour be in space which is filled, yet, seeing endeavour is motion, that which stands next in its way shall be removed, and endeavour further, and again remove that which stands next, and so infinitely. Wherefore the propagation of endeavour, from one part of full space to another, proceeds infinitely. Besides, it reaches in any instant to any distance, how great soever. For in the same instant in which the first part of the full medium removes that which is next it, the second also removes that part which is next to it; and therefore all endeavour, whether it be in empty or in full space, proceeds not only to any distance, how great soever, but also in any time, how little soever, that is, in an instant. Nor makes it any matter, that endeavour, by proceeding, grows weaker and weaker, till at last it can no longer be perceived by sense; for motion may be insensible; and I do not here examine things by sense and experience, but by reason.

8. When two movents are of equal magnitude, the swifter of them works with greater force than the slower, upon a body that resists their motion. Also, if two movents have equal velocity, the greater of them works with more force than the less. For where the magnitude is equal, the movent of greater velocity makes the greater impression upon that body upon which it falls; and where the velocity is equal, the movent of greater magnitude falling upon the same point, or an equal part of another body, loses less of its velocity, because the resisting body works only upon that part of the movent which it touches, and therefore abates the impetus of that part only; whereas in the mean time the parts, which are not touched, proceed, and retain their whole force, till they also come to be touched; and their force has some effect. Wherefore, for example, in batteries a longer than a shorter piece of timber of the same thickness and velocity, and a thicker than a slenderer piece of the same length and velocity, work a greater effect upon the wall.
which is contiguous to the fluid part, has no cause at all of elevation, that is to say, no endeavour towards A.

Secondly, let the hard superficies of the body at I be towards A. By reason, therefore, of the said change of place of the parts which are contiguous to it, the hard superficies must, of necessity, seeing by supposition there is no empty space, either come nearer to A, or else its smallest parts must supply the contiguous places of the medium, which otherwise would be empty. But this cannot be, by reason of the supposed hardness; and, therefore, the other must needs be, namely, that the body come nearer to A. Wherefore the body at I has greater endeavour towards the centre A, when its hard side is next it, than when it is averted from it. But the body in I, while it is moving in the circumference of the circle I B, has sometimes one side, sometimes another, turned towards the centre; and, therefore, it is sometimes nearer, sometimes further off from the centre A. Wherefore the body at I is not carried in the circumference of a perfect circle; which was to be demonstrated.

1. Endeavour and pressure how they differ.—2. Two kinds of mediums in which bodies are moved.—3. Propagation of motion, what it is.—4. What motion bodies have, when they press one another.—5. Fluid bodies, when they are pressed together, penetrate one another.—6. When one body presseth another and doth not penetrate it, the action of the pressing body is perpendicular to the superficies of the body pressed.—7. When a hard body, pressing another body, penetrates the same, it doth not penetrate it perpendicularly, unless it fall perpendicularly upon it.—8. Motion sometimes opposite to that of the movement.—9. In a full medium, motion is propagated to any distance.—10. Dilatation and contraction what they are.—11. Dilatation and contraction suppose nutation of the smallest parts in respect of their situation.—12. All traction is pulsion.—13. Such things as being pressed or bent restore themselves, have motion in their internal parts.—14. Though that which carried another be stopped, the body carried will proceed.—15, 16. The effects of percussion not to be compared with those of weight.—17, 18. Motion cannot begin first in the internal parts of a body.—19. Action and reaction proceed in the same line.—20. habit, what it is.

1. I HAVE already (chapter xv. art. 2) defined endeavour to be motion through some length, though not considered as length, but as a point. Whether, therefore, there be resistance or no resistance, the endeavour will still be the same. For simply to endeavour is to go. But when two bodies, having opposite endeavours, press one another, then the endeavour of either of them is that which we call pressure, and is mutual when their pressures are opposite.
Two kinds of mediums in which bodies are moved.

Propagation of motion, what it is.

What motion bodies have when they press one another.

Of Other Variety of Motion.

in a line perpendicular to the bodies pressing. But whenever the foremost parts of both the bodies are pressed, the hindmost also must be pressed at the same time; for the motion of the hindmost parts cannot in an instant be stopped by the resistance of the foremost parts, but proceeds for some time; and therefore, seeing they must have some place in which they may be moved, and that there is no place at all for them forwards, it is necessary that they be moved into the places which are towards the sides every way. And this effect follows of necessity, not only in fluid, but in consistent and hard bodies, though it be not always manifest to sense. For though from the compression of two stones we cannot with our eyes discern any swelling outwards towards the sides, as we perceive in two bodies of wax; yet we know well enough by reason, that some tumour must needs be there, though it be but little.

 Fluid bodies, when they are pressed together, penetrate one another.

OF OTHER VARIETY OF MOTION.

which the lighter body may ascend. For of the two bodies, that, whose parts are most easily separated, will be the first divided; which being done, it is not necessary that the parts of the other suffer any separation at all. And therefore when two liquors, which are enclosed in the same vessel, change their places, there is no need that their smallest parts should be mingled with one another; for a way being opened through one of them, the parts of the other need not be separated.

Now if a fluid body, which is not enclosed, press a hard body, its endeavour will indeed be towards the internal parts of that hard body; but being excluded by the resistance of it, the parts of the fluid body will be moved every way according to the superficies of the hard body, and that equally, if the pressure be perpendicular; for when all the parts of the cause are equal, the effects will be equal also. But if the pressure be not perpendicular, then the angles of the incidence being unequal, the expansion also will be unequal, namely, greater on that side where the angle is greater, because that motion is most direct which proceeds by the directest line.

6. If a body, pressing another body, do not penetrate it, it will nevertheless give to the part it presses an endeavour to yield, and recede in a straight line perpendicular to its superficies in that point in which it is pressed.

Let \( A B C D \) (in fig. 1) be a hard body, and let another body, falling upon it in the straight line \( EA \), with any inclination or without inclination, press it in the point \( A \). I say the body so pressing, and not penetrating it, will give to the part \( A \) an

endeavour to yield or recede in a straight line perpendicular to the line \( AD \).

For let \( AB \) be perpendicular to \( AD \), and let \( BA \) be produced to \( F \). If therefore \( AF \) be coincident with \( AE \), it is of itself manifest that the motion in \( EA \) will make \( A \) to endeavour in the line \( AB \). Let now \( EA \) be oblique to \( AD \), and from the point \( E \) let the straight line \( EC \) be drawn, cutting \( AD \) at right angles in \( D \), and let the rectangles \( ABCD \) and \( ADEF \) be completed. I have shown (in the 8th article of chapter xvi) that the body will be carried from \( E \) to \( A \) by the concourse of two uniform motions, the one in \( EF \) and its parallels, the other in \( ED \) and its parallels. But the motion in \( EF \) and its parallels, whereas \( DA \) is one, contributes nothing to the body in \( A \) to make it endeavour or press towards \( B \); and therefore the whole endeavour, which the body hath in the inclined line \( EA \) to pass or press the straight line \( AD \), it hath it all from the perpendicular motion or endeavour in \( FA \). Wherefore the body \( E \), after it is in \( A \), will have only that perpendicular endeavour which proceeds from the motion in \( FA \), that is, in \( AB \); which was to be proved.

7. If a hard body falling upon or pressing another body penetrate the same, its endeavour after its first penetration will be neither in the inclined line produced, nor in the perpendicular, but sometimes betwixt both, sometimes without them.

Let \( EAG \) (in the same fig. 1) be the inclined line produced; and first, let the passage through the medium, in which \( EA \) is, be easier than the passage through the medium in which \( AG \) is. As