

Universal Physics Journal

Article IV: The Nature of Force

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Purpose

The purpose of Article IV is to identify the various types of forces by studying the manner in which they affect matter. Several concepts for force are introduced include internal, external, stacking and acceleration/Reaction (a/R) forces. Consideration is also given to the origination of force, the termination of force, the central-object-perspective of force and the separation of forces into four distinct types.

Article IV

What is force? "A push or a pull experienced by an object" is a good place to begin this study. But do all forces "push" or "pull" upon objects in the same manner? I think not. As an experiment, I will take an ordinary compression spring scale (bathroom scale), tilt it on its side, and place the scale's "bottom" side flat against the surface of a vertical wall. Next I will arrange 4 paving bricks, each with a sea-level Earth weight of 1.5 pound.force (lb.f), next to each other so that the "bottom" of Paver 1 is in full contact with the "top" or display side of the scale and Paver 2 is in contact with Paver 1 and Paver 3 is in contact with Paver 2, and Paver 4 is in contact with Paver 3. The end result of this arrangement is that the 4 pavers will form a "stack" of pavers that is lying on its side on the floor while maintaining contact with the sideways scale which remains in contact with the vertical surface of the wall.

(2) What pair of forces could I possibly be intending to measure with this curious arrangement of objects? Left alone, the sideways "stack" of pavers will cause no visible force reading to be displayed by the scale against the wall, just as one might expect. Next I will have you assist me in these matters by holding a small compression scale in your hand while pushing the bottom of this small scale with an increasing external (contact) force against the side of Paver 4 in the direction of the wall. When the small scale in your hand displays a 6 lb.force reading against Paver 4, you will note that the large scale also indicates the presence of the same 6 lb.force between Paver 1 and the wall. I will have you maintain this 6 lb.force reading on both scales for a minute or so while we consider this event.

(3) As you push with an external 6 lb. action force against Paver 4, Paver 4 transfers this same force through its structure to bear as an external 6 lb.force against Paver 3. Paver 3 repeats the transfer of the external force of your push to Paver 2 while Paver 2 transfers on your 6 lb. push along this sideways "stack" to Paver 1 which is transferring the same 6 lb.force to the display side of the scale. Upon first receiving the external force of your push, the scale moves slightly in the wall's direction, compressing a bit in thickness as it comes to bear against the wall with a force

that is also 6 pounds in magnitude. Upon receiving the 6 lb.f from the "bottom" of the scale, the wall reciprocates with a 6 lb.f of its own acting against the "push" from the scale. In the process, the wall deflects or bows away from the scale a little as it provides its own action force in opposition to the action force it is receiving from the scale.

(4) Why is the 6 lb.f force from the deflected wall not a reaction force? This event contains a good example of an Action Force Loop. Here in this non-accelerative event, as much as you push horizontally forward with an event-causing action force against the small scale with your hand, your feet push horizontally rearward with an event-causing action force against the floor. Tension action forces in the floor between your feet and the wall are transferred in both directions along their part of the loop. Compression action forces between the wall and the small scale in your hand are transferred in both directions through the pavers. With action forces looping in both directions around this Action Force Loop, there simply is no role left for reaction forces to fill in this non-accelerative event. Here, as well as in every other non-accelerative event, no reaction forces are present. (See Article XI: Reaction Forces.)

(5) From the scale's perspective, it is being subjected to equal and opposite external action forces from the "stack" of pavers on one side and from the wall on the other side. This type of observation employs what I refer to as the "central object perspective" whereby the observer considers the forces being experienced by a single object by asking the question: "How do the forces affecting the object in one direction relate to the forces affecting the object in the opposite direction." This central-object-perspective may be applied to the scale or to any of the other objects along the series.

(6) Now let us consider the results so far. The external action force from the small scale in your hand bears against Paver 4 which transfers this same external action force through its structure to Paver 3, then on to Paver 2, and to Paver 1 until it finally reaches the large scale. The large scale compresses in thickness as it transfers this same undiminished external action force through its structure and on to the wall. The wall bows away a bit as it provides an equal and opposite action force against its "bottom" side of the scale. In fact, this looping external action force from the wall is transferred undiminished all the way back to your hand by the large scale, each of the 4 pavers, and the small scale you are holding in your hand. If one draws a force vector to represent each occurrence of the external action force impressed against every object in the series beginning at the small scale in your hand and ending at the wall, one will have to note that each force vector directed toward the wall represents the same force being repeated again and again from object to object on the way to the wall. Since this is but one force being transferred externally from object to object along a series, I refer to it as an "external serial transfer force". When a force is transferred in this serial manner, it is not additive to itself for in every occurrence it is but one and the same force.

Type 4 Bipole External Action Force

(7) In this event, we are witness to equal external action forces acting in opposite horizontal directions at any point around the Action Force Loop. I see the horizontal force of your push as an action force against the small scale in the direction toward the wall. I see the horizontal force of the push of your feet against the floor as an action force in the direction away from the wall.

Each force is an action force capable of causing an accelerational event. The only difference between the two is your intent. Is your intent to brace yourself against the floor so you may bear with some horizontally-directed action force against the small scale? Or is your intent to brace yourself against the small scale so you may bear with some horizontally-directed action force against the floor? As you can see, intent is insufficient to cause one of these forces to be any different from the other. Thus I conclude that both are action forces with each being responsible for all horizontal forces present in the appropriate direction around the action force loop. Most importantly, neither action force can exist without the presence of the other "mutual" action force. I shall refer to either of these two mutual looping serial action forces as a Type 4 bipole external action force. With Type 4 action forces accounting for every force present around the loop, there exists no role for reaction forces to fill. Therefore no reaction forces exist at any point around the loop in this non-accelerational event.

(8) Now that we understand how a Type 4 bipole external action force remains the same force as it is being transferred from object to object along a series of objects and therefore is not additive to itself along that series, I will ask you to take the large compression scale away from the wall and place it in a normal manner against the floor. Initially, instead of stacking the pavers on the scale, I want you to arrange them so that each paver is in direct contact with the scale. Note that the force reading the scale displays is again 6 pounds as the scale is displaying the combined external action force of the 1.5 lb. Earth weight that each of the 4 pavers is freely applying to the top surface of the scale. Reflect on the fact that in the sideways event, each paver is generating no sideways force of its own that it is freely impressing against the sideways scale and the wall, yet here in the gravitational event each paver is generating its own force of Earth gravitation with the result that each paver is freely impressing a 1.5 lb action force against the scale and Earth below. This gravitation force is being generated separately within each component of the matter of each paver for each single component impresses the force of its own weight against Earth. Remove a single component of matter from one of the pavers and the gravitational weight of that paver is lessened by the gravitational weight of the missing component.

(9) Accordingly, I refer to the measurable force of gravitation as being an internal force for logic indicates that it is being generated internally within each component of an object's matter. Notice that as it is with all internal forces, gravitation needs only to act in one direction to exist. Hence it is monopole in nature. For example, using the central-object-perspective, a single component of matter located on the top surface of any one of the pavers is able to push toward the scale below with the downward force of its Earth gravitation without having to push up with an equal force against any component above. Overall, due to the accumulation of the myriad of internal forces of gravitation from its myriad of components, one paver is able to push with a total 1.5 lb. force down against the large scale without being required to push up with an equal force against any object above.

(10) This is not so when external forces are being transferred in opposite directions through the central object. For example, when using the central-object-perspective during the previous sideways "stack" event, each paver is successfully pushing on the next object in the series in the direction of the wall with a Type 4 bipole external action force of 6 pounds from your hand only because this same paver is pushing in the opposite direction toward your hand with a mutual Type

4 bipole external action force of 6 pounds from the wall. These two equal and opposite external action forces impressed by the central object in both directions are mutual forces for neither can exist in one direction without the existence of the other in the opposite direction. Every Type 4 bipole external action force in one direction requires a mutual Type 4 bipole external action force to be present in the opposite direction, relative to a central object. Should an imbalance exist in opposing directions between bipole external forces, using the central object perspective, then only the external forces that exist in both directions from zero on up to the balance point are Type 4 while the remaining external force that exists in only one direction above the balance point is Type 3. (Understand that this net Type 3 external force is not unopposed for it has its own internal force of opposition or support sourced from within a neighboring object.)

Type 3 Bipole External Stacking Force

(11) Returning to our current event where the pavers are individually impressing their force of weight directly against the scale, the measurable internal (generated) force, caused in this case by gravitation, makes it so that a central component of matter, located within one of the pavers, is able to push in one direction without having to push in the opposite direction with an equal force. Internal forces exist only within individual components of an object's matter, not collectively at the outer surface of the object. So while the 1.5 lb. force that one of the pavers is freely impressing against the scale is mostly a Type 3 bipole external stacking force, it is being caused by the accumulation of the myriad of internal generated forces sourced from within each of the paver's components of matter. The paver's exterior components that are collectively in contact with the surface of the scale are able to push down with nearly 1.5 pounds of Type 3 external stacking force because they are pushing up with an equal Type 3 external stacking force of nearly 1.5 pounds against neighboring paver components located immediately above. The reason the paver's lowest exterior components are actually pushing down with the slightly greater force of a full 1.5 pounds is that they are adding the internal generated force of their own Earth gravitation to the Type 3 external stacking forces received from components above and are impressing this greater combination of Type 3 bipole external stacking forces and monopole internal generated forces down as the full 1.5 lb. Type 3 external stacking force impressed against the scale below.

(12) Type 3 bipole external stacking forces are present in both vertical directions throughout the matter of each paver in this weighing event. In the downward direction, their job is to collect the myriad of downward-directed internal forces of gravitational weight being generated within each component of a paver's matter, and to deliver this external action force that stacks up in the direction of the scale as the paver's Type 3 bipole external stacking force of Earth gravitational weight against the scale below. In the upward direction, they provide 100% support for each component of the paver's matter thereby preventing each component from taking on an accelerated motion in the direction of Earth's core. Note that this is a linear event where the Type 3 bipole external stacking forces are being caused to stack up in the downward direction by downward-directed monopole internal forces of gravitation. No looping of forces is occurring as is often the case in Type 4 external action force events.

(13) Now let us look at the downward-directed internal action forces that are the fundamental cause of this weighing event. A component's internal force has two forms of existence: 1) a Type 2 monopole internal force with one exterior head that bears in a linear manner against the exterior

head of a Type 3 external stacking force from components beyond the component, or 2) a Type 1 monopole internal force with one interior head that bears exclusively against the interior heads of other internal forces that are also being actively or reactively generated within the same component of matter.

Type 2 Monopole Internal Force

(14) A Type 2 monopole internal force occurs when a portion of the internal forces being generated within a single component of matter exceeds the opposing internal forces being generated within the same component of matter resulting in this excess internal force seeking and finding external opposition against external forces from components beyond the physical boundary of the single component. (See Event 5: "The Physics of Earth's Tides") Such an excess portion of an internal force is specifically a Type 2 monopole internal force with one exterior head. It is a monopole force for it is able to push in one direction from the single component without there being the requirement that a mutual force exists in the opposite direction, as is required of every Type 3 and Type 4 bipole external forces. A good example of a Type 2 monopole internal action force is the force of gravitational weight from each of the paver's components. Each of these Type 2 monopole forces is internally generated within a single component of the paver's matter yet freely bears with the exterior force of its own Earth gravitational weight in the downward direction against the structure of other components below.

Type 1 Monopole Internal Force

(15) Last for us to consider is a Type 1 monopole internal force whose presence is always the easiest to misunderstand, or worse, to completely overlook. A Type 1 monopole internal force, like a Type 2 monopole internal force, is always actively or reactively generated, by one cause or another, within the interior of a single component of an object's matter. While the Type 2 monopole internal force is the excess portion of such a component's internal forces that bears with an exterior force against components beyond the single component, every Type 1 internal force bears equally and oppositely with an interior force against the combined total of all the other interior forces being generated within the same component of matter. Thus a Type 1 internal force is always balanced by the remaining Type 1 internal forces present within the component.

(16) To recognize how we tend to overlook the presence of Type 1 monopole internal forces in our paver example, consider how easily and obviously we can measure the combined Type 2 monopole internal forces that escape from each of the paver's components as the excess portions of the internal forces being generated within those components. As we bear witness to the combined magnitude of the paver's Type 2 monopole internal forces that cause the paver to freely bear with the external force of its 1.5 lb Earth weight against the scale, realize that this information tells us nothing about the Type 1 internal forces that remain balanced within each of the paver's components. Since there is no escape from the component for these equally opposed Type 1 internal forces, their presence is easy to overlook. Yet their causes may be as numerous as there are bodies in the Universe with these causes resulting in accelerations of the component as it rides as a passenger on Earth.

(17) For certain there exists no direct method to measure the magnitude and direction of a Type 1 monopole internal force for it interfaces equally and oppositely against the remaining Type 1

monopole internal forces being generated within the same component of matter. Even if one could divide a component of matter in half and insert an impossibly small scale between each half, the scale would display no force reading at all for the Type 1 monopole internal forces previously present within the whole component will now be acting and reacting in the same balanced manner within each half-component with none left over to bear externally against the scale and the other half-component beyond.

(18) The Type 1 monopole internal forces present in each component of our pavers include all the gravitational forces being generated in response to the gravitational energy emissions received by each such component sent through space at the speed of light energy from all other components of matter located both near and far in the Universe. Bodies with larger quantities of matter located nearer to our paver's components emit energies that when received cause the generation of greater Type 1 monopole internal gravitational forces within the paver's components based upon strict geometric laws that are remarkably well-identified within Isaac Newton's work written centuries ago. Every such Type 1 force caused by the component's reception of energy emissions from each component of Earth, the Moon, the Sun, the remaining planets in the Solar System, along with emissions from all other bodies in the Universe, has an effect upon the magnitude and direction of the Type 1 forces present within each of our paver's components of matter. As Earth rotates about its own axis, and Earth and the Moon orbit their common axis and so on..., the Type 1 internal gravitational forces caused by Earth, the Sun, the Moon, and other space bodies will alternately shift the balance of each of the paver's component's Type 1 monopole internal forces effecting an increase or decrease in the excess portions or Type 2 monopole internal forces that leave the paver's components to find external support against the scale and Earth below.

(19) Also present within our paver's components are the benign Type 1 forces of acceleration/Reaction that have been almost completely ignored up to now. (See Article I and Article III) These Type 1 internal a/R forces are always equal in magnitude and opposite in direction to the net acceleration/Action force that is present as the cause of the component's acceleration. Consider the weighing of our paver at Earth's equator. Here the paver is being continually accelerated away from a straight line path to follow instead a curved path about Earth's axis. The primary force affecting the paver's matter is the downward-directed internal Earth Gravitational force present within each of the paver's components of matter. A small portion of this Earth gravitational force (1/330) is acting as the cause of the paver's inward-directed (downward-directed) centripetal acceleration about Earth's axis. This internal net acceleration/Action force (not "net force") is causing the paver's centripetal acceleration while also causing the reactive generation of its own support force in the form of the paver's outward-directed (upward-directed) internal acceleration/Reaction force. In this event, both the a/A force and a/R force are internal forces, making this a weightless accelerational event. This means that none of the a/A force is left unsupported and therefore has no need to seek support outside its component. This also means that this a/A force has no role as the cause of the paver's force of weight against Earth. In this manner, this a/A force comes to an end while causing the component's centripetal acceleration. This leaves the paver with less Earth gravitational force to act as the cause of its inward-directed (downward-directed) weight force against Earth. It is the reduction in the paver's Earth gravitational force due to a small portion of it acting as the cause of

the paver's centripetal acceleration that results in the paver weighing less against Earth's equatorial surface.

(20) When opposing Type 1 monopole internal forces are perfectly balanced within a central component of matter, leaving no excess Type 2 monopole internal forces present to bear against components beyond, the central component is in the weightless state of internal equilibrium. Since one of the possible internal forces is the reactive force of acceleration/Reaction, internal equilibrium can occur during the acceleration of an object if the acceleration-causing action force is a Type 1 internal force such as gravitation and the object is accelerating freely within a friction-free environment. Thus an object that is freely accelerating down a vacuum well on Earth will experience the weightless state of internal equilibrium as the "downward" Type 1 monopole internal acceleration/Action forces of the object's Earth gravitation causes the acceleration that causes the generation of the object's exactly equal and exactly opposite "upward" Type 1 monopole internal forces of acceleration/Reaction. No excess Type 2 internal forces are present. The object's internal forces are in balance. If you were this object and you were accelerating down the vacuum well while wearing a space suit with a blackened face shield, you would feel weightless, at peace and at rest. You would be completely unaware of your body's high rate of acceleration directed toward Earth's core.

(21) The same conditions apply to an astronaut hovering weightless within the cabin of the N.A.S.A. Space Shuttle while the Shuttle is in stable orbit of Earth. The "downward" Type 1 internal forces of the astronaut's Earth gravitation will cause the astronaut's acceleration that causes the generation of the astronaut's equal and opposite Type 1 internal forces of acceleration/Reaction. In this weightless event, no excess Type 2 internal forces are present to give the astronaut the external force of weight against any other object. Curiously, there is nothing to differentiate one truly weightless state of internal equilibrium from another as long as the object is small in size. A non-accelerating object in internal equilibrium in the space between two binary bodies in this galaxy is in the same state of internal equilibrium as another such object that is accelerating at a high rate down a vacuum well on Earth.

(22) If you were the object experiencing internal equilibrium, you would not be able to feel any difference between non-accelerating internal equilibrium and accelerating internal equilibrium. It is for this reason, the astronauts on their way to visit the Moon have to be told exactly when their negative acceleration, experienced while departing from Earth, switches to positive acceleration while approaching the Moon. They are in internal equilibrium the entire time and can detect no difference between acceleration directed toward Earth, no acceleration directed toward Earth or the Moon, and then later on, acceleration directed toward the Moon provided that in each case, the acceleration is caused by a Type 1 internal force, such as gravitation, and not by the external push from a Type 3 force such as the thrust from a gas jet or rocket. The astronauts are in the same weightless state of internal equilibrium the entire time and have not a clue as to the accelerative changes going on inside their bodies. This is because as the Type 1 internal acceleration/Action force of gravitation being generated within the components of the astronauts bodies increases or decreases, the opposing Type 1 internal acceleration/Reaction force being reactively generated within the same components automatically increases or decreases in a proportional manner thereby always maintaining a perfect balance. A balance is a balance,

regardless of the magnitude of the opposing forces involved. No acceleration, mild acceleration, or strong acceleration, it matters not. As far as the weightless astronaut is concerned, these events all feel the same. In fact unless the astronaut is provided with visual clues, he or she will be completely unable to detect whether acceleration is absent or present during such weightless, internal equilibrium events.

The acceleration/Reaction Force of Matter

(23) Now it is time to take a good look at inertia's replacement, that being the acceleration/Reaction force or a/R force of matter. First of all, understand that an acceleration/Action force is that portion of a given action force that is exclusively responsible for the acceleration of the components of an object. An ordinary example is when you slide a heavy Physics book along a table top by pushing on it with the same small hand-held compression scale used in our first experiment to push against the horizontal "stack" of pavers. Suppose you observe that it takes a 1 lb.force (4.448 N), as indicated by the scale, to slide the Physics book along at a uniform pace. Then you discover that when you apply a steady 2.5 lb.f, the book accelerates to a faster and faster pace as it slides along the table. You already know that the forces of friction acting in both directions between the book and the surface of the table remain fairly constant during this event regardless of how fast you slide the book. You have measured these frictional forces to be about 1 lb.f in magnitude.

(24) When you increase the action force of your push to 2.5 pounds, you observe that the book accelerates to a faster and faster pace as it slides along the table top. The scale in your hand now displays a 2.5 lb.force reading. You know that 1 lb of this force is acting as the cause of the friction that occurs as the book is sliding in a uniform manner at any speed you are capable of causing by hand for the book. So this means that the remaining 1.5 lb.force from your hand must be the force that is acting as the cause of the book's acceleration. Logically this is true since when you push with a steady 1 lb.force, the book slides along without accelerating and when you add the second 1.5 lb.force to your push the book immediately switches from sliding at a steady speed to sliding at speeds that are increasing or accelerating. This second 1.5 lb.force is the acceleration/Action force portion of the 2.5 lb.force of your push. It has no role in opposing friction (neglecting air friction) and instead is solely the force responsible for the Physics book's acceleration. This means that of your 2.5 lb. action force against the book, 1 lb. is the friction-causing non-acceleration/Action force and the remaining 1.5 lb.force is the acceleration-causing acceleration/Action force.

(25) As you perform the experiment again and again with a higher and higher force, you observe a higher and higher force reading being displayed by the scale in your hand while you also observe the book accelerating at a higher and higher rate along the table. Since only about 1 lb of the displayed force is spent causing friction, you now recognize that the remaining portion of the displayed force is solely the acceleration/Action force responsible for the book's acceleration. But what of the remaining reaction force from the book that is bearing back against the opposite side of the scale from your hand?

(26) You note that this remaining reaction force does vary exactly with any variation in the accelerative portion of your action force. For example, when you push with a 5 lb. action force, 1

lb. is the friction-causing action force which leaves a 4 lb. acceleration-causing action force (acceleration/Action force) that causes to exist its own equal support in the form of a 4 lb. acceleration-caused reaction force (acceleration/Reaction force) being reactively generated deep within the interior of each component of the accelerating book's matter.

(27) The difference in this event between the acceleration-preventing friction and acceleration-allowing acceleration/Reaction force is the difference between external and internal forces. Friction is always a Type 3 or Type 4 bipole action force meaning that as much as a friction force bears with one external force against the book, a mutual partner friction force bears with an equal external force in the opposite direction against the table. Hence the 1 lb. force of your action force is not free to act as the cause of the book's acceleration.

(28) By contrast, the book's own reactively generated acceleration/Reaction forces are always internal forces. In this event, the acceleration/Action force of your push begins as a Type 4 bipole external force you impress against the scale. The scale transfers your push in a serial manner on to the book. As your push enters the book's matter it becomes a Type 3 bipole external stacking force as it stacks down while acting as the cause of acceleration for each of the book's components of matter. Meanwhile, each of the accelerating components is reactively generating a Type 2 monopole internal acceleration/Reaction support force with its single exterior force bearing rearward in the direction opposite to the direction of the book's forward acceleration.

(29) (Note in my description of this accelerational event, Newton's LAW III is fully embraced since every force is directly opposed by a force of equal magnitude. This fundamental truth is supported by the experimental fact that no matter where a scale is inserted, during the event it will always display the presence of equal and opposite forces. Supporters of the fully accepted, peer reviewed, "net force" theory of acceleration avoid the use of scales while making the unsupported claim that an imbalance of forces exists during accelerational events. Newton's LAW III and Rule 7b of the Universal Physics Rules for Force & Motion, Article X both tell us that no such imbalance of forces can ever exist in any Physics event, regardless of whether acceleration is present or absent. The truth is every force present is immediately opposed or supported by another force that is equal in magnitude and opposite in direction. Perhaps this truth has been difficult to recognize and understand in accelerational events due to the unique characteristics of each component's acceleration/Reaction force. This reaction force does not have a cause separate from the action force that is forcing the component's acceleration. Instead, each component's internal acceleration/Reaction force is caused by and so is a natural byproduct of the a/A force and therefore supports but has no power to cause any reduction or cancellation of the a/A force nor of the acceleration it is forcing to exist. So says Newton's LAW III, so says the Universal Physics Rule 7b, and so says a force measuring scale whenever and wherever it's service is employed.)

(30) When you push on the book with a 10 lb. action force, again 1 lb. of force is spent causing friction while the remaining 9 lb. force is spent causing acceleration for the book. Now the scale in your hand displays a 10 pound Type 4 bipole action force opposed by the 1 pound Type 4 bipole non-acceleration/Action force of friction with the table and supported by the 9 pound Type 3 bipole external stacking force that is fully present throughout the book's matter as it collects each

component's Type 2 monopole internal acceleration/Reaction force which represents the book's support force for acceleration. Overall, the compression scale in your hand helps you to recognize and understand that all forces present during this accelerative event are opposed or supported by equal forces in perfect agreement with Newton's LAW III and Rule 7b.

(31) Now I would like you to open the Physics book and look up the section on acceleration to read about how a supposed "single" or "net" or "unbalanced" or "resultant" force is claimed to act alone as the cause of the book's acceleration with no acceleration/Reaction force present. Most likely the book will lay credit for this "net" force theory directly at Isaac Newton's feet by stating that his 1st Law of Motion tells us that a body at rest remains at rest and a body in uniform motion remains in uniform motion unless acted upon by a "net" force.

(32) Isaac Newton's actual LAW I, as translated into English in PRINCIPIA makes no reference to acceleration being caused by a "net" force.

Newton's LAW I

"Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it." [1]

To deny that the acceleration/Action forces, mentioned in Newton's LAW I cause the existence of their own equal and opposite acceleration/Reaction forces is to deny the truth of Newton's LAW III. whereby every action force, including the acceleration/Action force in LAW I, is always opposed (or supported) by an equal force.

Newton's LAW III

"To every action there is always opposed an equal reaction: or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts." [1]

(33) For certain Newton could have made his understanding of how mutual action and reaction forces bring about the acceleration of matter a bit more clear. Perhaps the "net" force theory regarding the acceleration of matter grew out of someone's misunderstanding of Newton's work. Yet such a misunderstanding should have been corrected a long time ago when it was first recognized that the "net" force theory was in direct conflict not only with Newton's LAW III but also with the force displays of ordinary compression scales such as the one used during our accelerating Physics book event. While the first "net" force theorist who altered Newton's LAW I may have had good intentions, for certain he changed Newton's LAW I from a law that is in agreement with LAW III and Rule 7b of the Universal Law of Mutual Forces, to a false and misleading statement of less than law status regarding the forces present during an object's acceleration. This common practice of attaching the false "net" force theory interpretation to Newton's LAW I must come to an end. For certain there is no evidence in our sliding Physics book event that suggests that anything other than mutual forces are present.

(34) Are you ready to return to considering our paver weighing event? Let's set up the vertical portion of this experiment while keeping our new understanding of Type 2 monopole internal forces in mind. Begin by stacking the 4 pavers on top of each other with Paver 1 in full contact with the scale, Paver 2 on top of and in full contact with Paver 1, and so on until Paver 4 rests on top of this vertical stack. Once again, a check of the force reading displayed by the large scale

below reveals the same display of opposing 6 lb. forces as when the 4 pavers were each in contact with the surface of the scale. Now consider how the weight forces from the 4 pavers stack up in the direction of the large scale below. Paver 4 is freely bearing against Paver 3 below with the downward-directed Type 3 bipole external stacking force that is responsible for accumulating the myriad of downward-directed Type 2 monopole internal Earth gravitational action force being generated separately within each of Paver 4's myriad of components of matter. These Type 2 forces stack up in the direction of Paver 3 and the scale below. Meanwhile, an equal and opposite upward-directed Type 3 bipole external stacking force exists to provide support for as it stacks down against each and every component of Paver 4's matter. The total downward-directed Type 3 external stacking force against Paver 3 is 1.5 pounds. The 3 pavers below act in series to transfer down, in an undiminished manner, this 1.5 lb. Type 3 external stacking action force as a serial transfer Type 4 bipole external force until it bears against the top surface of the large compression scale below. Meanwhile Paver 3 freely bears with its own 1.5 lb. Type 3 bipole external stacking force, caused by the Type 2 monopole internal Earth gravitational forces of each of its myriad of components, against Paver 2 below. This external action force is also transferred down as a serial transfer Type 4 force in an undiminished manner along the remaining two pavers to bring the force against the scale up to 3 pounds. Paver 2's Earth gravitational weight is also transferred down as an serial transfer Type 4 force to the scale increasing the force to 4.5 pounds. Finally, Paver 1's Type 3 bipole external force of its gravitational weight increases the total force impressed against the scale to its final magnitude of 6 pounds.

Stacking Forces

(35) Now I want you to consider how the forces present during our paver-weighing event stack up or increase from paver to paver in the direction of the scale. Remember how no such stacking of forces occurred along the horizontal "stack" of pavers in the direction of the wall in our first event? During that event, your Type 4 bipole external force of 6 pounds was transferred without change from paver to paver in the direction of the wall. Yet here during the vertical event, the forces measurably present in both directions between each pair of pavers increase as you approach the scale. While the cause of this stacking of forces may be obvious to you, I want us to examine this effect for it is a reliable indicator of the types of forces present during many events.

(36) Beginning at the top of the stack of pavers, the downward exterior heads of Type 3 bipole external stacking forces bear with the force of Paver 4's Earth gravitational weight against Paver 3. The equal and opposite upward exterior heads of these same Type 3 bipole forces bear against what? There are no pavers located above Paver 4. The answer lies within the matter of Paver 4 itself. After all, the majority of the forces present during this weighing event are being caused by the gravitational forces being generated internally within each and every component of matter present. Paver 4 certainly contains a myriad of such components and each is bearing in the direction of Paver 3 with the excess portion of its internal forces as a Type 2 monopole internal force. This Type 2 internal force has but one downward exterior head that bears as an external force against the structure of components below. It is against these downward Type 2 external forces that the upward Type 3 external forces find equal opposition. In fact the upward Type 3 forces stack "down", in the upward direction, as portions of them terminate against individual downward Type 2 forces being generated within components located higher and higher within the body of Paver 4. By the time the last remaining portions of these upward Type 3 forces reach the

last remaining components of matter located in the top surface of Paver 4, these upward Type 3 forces are just equal in magnitude to the downward Type 2 forces against which they terminate.

Termination of Force

(37) Looking at this weighing event from the top down, the downward forces present within Paver 4 originate within each of the paver's components as the excess portions of the internal forces being generated therein. This excess portion bears as the downward exterior force of a Type 2 monopole internal force against the structure of components below. Once this excess portion of a component's internal forces leaves the component it is transferred as an external force from component to component, from paver to paver through the components of the scale and continuing on deep within Earth's structure with portions finding termination against individual components of Earth's matter. As difficult as it may be for you to imagine, by the time the last remaining portions of the Type 2 internal forces originating within our 4 pavers reach the last of Earth's components on the far side of Earth, they are just equal in magnitude to the opposing Type 2 internal forces originating within the last of Earth's components in the paver's direction against which the paver's forces terminate.

(38) You didn't think that we were just weighing the 4 paving stones against Earth did you? If it helps, remove the 4 pavers from the scale, turn the scale over, and repile the pavers on the "bottom" of the scale. Now can you see how the scale is measuring the force of Earth's gravitational weight against the 4 pavers? No? Suppose you piled so many pavers on the "bottom" of the scale that their total quantity of matter equaled twice that of Earth. Now it is easy to accept that Earth is the one being weighed, is it not? Yet since both Earth and our "Super" pile of pavers are freely bearing with an external force against the other, assuming it remains operational, is the scale not displaying the weight of Earth against the pavers in one direction and the weight of the pavers against Earth in the opposite direction? Is Earth's weight against the pavers not exactly equal to the weight of the pavers against Earth? Now start removing pavers from the "bottom" of the scale. With each paver you remove, is the scale not registering Earth's reduced weight against a reduced pile of pavers? At what point do you no longer consider that Earth's "paver weight" is being measured? Actually, this point occurs only after the last paver is removed from your side of the scale.

(39) With our scale flipped right side up and the 4 pavers arranged once again in a vertical stack, consider that you are witness to a linear event where Type 2 internal forces of Earth gravitation are originating within the components of all 4 pavers bearing in Earth's direction and Type 2 internal forces of paver gravitation are originating within all of Earth's components bearing in the paver's direction. These Type 2 internal forces are collected and transferred for thousands of miles in a linear manner from the sites of their origination within Earth and within the pavers to the sites of their termination against opposing Type 2 internal forces within the pavers and within Earth. After being generated within Earth, each Type 2 internal force is transferred in an undiminished manner across this vast distance as a small portion of a Type 3 external stacking force that collects such Type 2 internal forces as it passes through their structure in the direction of the scale. The same is true for the forces being generated with the 4 pavers except that the distance to the scale is greatly reduced. In general, using the central object perspective, each component of matter within each paver is receiving a Type 3 external stacking force from

components above, adding its own Type 2 internal force and applying this greater combined force against the upward exterior heads of Type 3 external stacking forces from components below. Thus the forces between components stack up in the direction of the scale both through Earth and through the stack of pavers. In this manner, the stacking up or stacking down of forces indicates the presence of Type 2 internal forces adding to the Type 3 external stacking forces in one direction as an origination force or subtracting from the Type 3 external stacking forces in the opposite direction as a termination force, depending upon your perspective of the event.

(40) Remember when you pushed using the small hand-held scale against the side of Paver 4 in the direction of the wall with a 6 lb.force in our horizontal "stack" event? What do you think will happen if you push down on the top of Paver 4 with the same amount of force in our current vertical stack event? The effect will be just the same as the effect of your horizontal push during the earlier event. Here the external force of your 6 lb. push will transfer undiminished down to the scale which will now display a 12 lb.force. Paver 4 will receive your 6 lb.f, add the external force of its own weight and pass this combined total force on as a 7.5 lb.force against Paver 3 below. Paver 3 will receive this 7.5 lb.force, add its own 1.5 lb.force and transfer on down a 9 lb.force. Paver 2 receives the 9 lb.force and transfers on down a 10.5 lb.force. Finally, Paver 1 receives the 10.5 lb.force, add its own 1.5 lb.force and transfers on down the full 12 lb.force as displayed by the scale. Of course we are no longer weighing the stack of pavers for they are no longer bearing in a free manner against the scale. If you want to track all the forces present during this new event, it will be best if you stand on your own scale while pushing down on the stack of pavers with the 6 lb.force. This way you can observe that in doing so, your own scale will register a force display 6 pounds less than the force of your normal weight against Earth.

(41) As a Type 1 or Type 2 internal force, gravitation is always an action force. As much as the action force of the gravitation of the 4 pavers toward Earth is causing the force of the 4 pavers' weight against the top of the scale, the action force of the gravitation of Earth toward the 4 pavers is causing the force of Earth's weight against the bottom of the scale. Under the following conditions, with each of these two action forces providing mutual support and termination for the other, there are no reaction forces present during this event. (Conditions: Earth and the pavers are located far from any other large body. Earth is not experiencing rotation or any other form of acceleration.)

(42) Before completing our paver and Earth weighing event, there is one problem for logic that needs to be resolved. How is it that even though Earth contains so much more matter than do the 4 pavers, the force of Earth's weight against the 4 pavers is exactly equal to the force of the 4 pavers' weight against Earth? Realize first that gravitation is a component to component event. Each paver component is generating a separate force of gravitation toward each Earth component, both near and far. When these relatively great number of separate forces are combined, the paver component gravitates quite strongly toward Earth. Meanwhile each Earth component is generating a separate force of gravitation toward each paver component. When these relatively few number of separate forces are combined, the Earth component gravitates quite weakly toward the pavers. Thus the relatively few paver components bear quite strongly toward the top of the scale and the relatively many Earth components bear quite weakly toward the bottom of the scale. The end result is that the external force of the paver's weight against Earth is

exactly equal to the external force of Earth's weight against the pavers as correctly predicted by the concept of mutual force, by the second half of Newton's LAW III and by part 3 of the Universal Law of Mutual Forces.

(43) Are you wondering if there are other events where the stacking of an internal force other than gravitation is apparent? Certainly there are such events. Since the acceleration/Reaction force is also an internal force, let us consider an event where the a/R forces being generated within the components of an object's matter are stacking up in the direction opposite to the direction of the object's acceleration. In fact, I don't see any reason why we can't employ the same 4 pavers arranged in the same horizontal "stack" during our first event when you pushed the stack against a wall. This time the "wall" will be a vertical cross-hull bulkhead in a vehicle such as an airplane on a horizontal runway or an automobile on a horizontal road. One of these vehicles will provide the acceleration/Action force that will cause the horizontal acceleration of the scale and the 4 paving stones. After placing the scale sideways against the front side of the cross-hull bulkhead, and arranging the 4 pavers in a horizontal stack on a nearly frictionless surface (a 1/4" thick uhmw plastic sheet will do nicely.) on the horizontal floor in front of the scale and sliding the pavers back against the scale, you signal the operator to begin the vehicle's horizontal acceleration run.

(44) A moment after acceleration occurs to the vehicle, acceleration occurs to the stack of pavers. This acceleration is caused by a secondary external serial transfer action force from the bulkhead impressed against the scale and then on to bear against the stack of pavers. Let's set the rate of the vehicle's acceleration equal to 2/3 the initial rate of acceleration caused by the acceleration/Action force of Earth gravitation when applied to a suddenly unsupported object on Earth. Whereas a 6 lb. action force of Earth gravitation is prepared to cause acceleration for our vertical stack of pavers should the support from the scale suddenly vanish in the previous paver weighing event, here in our horizontal vehicle acceleration event, the forward acceleration/Action force from the scale is exactly 4 pounds against the 4 pavers. Since the scale is also being accelerated, I will assign it a quantity of matter that is equal to that of one paver. Thus the scale also has an Earth weight of 1.5 lb.force and will automatically cause the bulkhead to apply an additional 1 lb. of acceleration/Action force in order to keep the paver's rate of acceleration at the predicted 2/3 of causing the scale's rate of acceleration to match the rate of acceleration of the 4 pavers.

(45) Now let us have a look at the horizontal forces present during this horizontal accelerative event. The cause of the acceleration of the 5 objects, including the 4 pavers and the scale, is the forward 5 lb. action force from the bulkhead. Since all 5 objects contain equal quantities of matter, and since each object is being accelerated at the same rate as the every other object, it is logical to accept that each 1 lb. quantity of the bulkhead's action force is responsible for accelerating one of the 5 objects.

(46) Applying the central-object-perspective to the scale, the scale is experiencing a Type 3 bipole external stacking force of 4 pounds that it is receiving from the bulkhead and passing forward in an undiminished manner to ultimately act as the cause of acceleration of the 4 pavers. In addition, the scale is also the central object to a second Type 3 bipole stacking force of 1 lb.

from the bulkhead that passes forward through its own components of matter to eventually terminate against the myriad of equal and opposite rearward-directed Type 2 monopole internal acceleration/Reaction forces being reactively generated within each component of the scale's matter. Notice that due to the scale's acceleration being caused by this second Type 3 bipole external stacking acceleration/Action force of 1 lb., the scale is bearing rearward against the bulkhead with a 1 lb. greater force than it is bearing forward against the 4 pavers.

(47) In a like manner, Paver 1 is receiving the 4 lb. combined action force from the scale, providing termination for its 1 lb. of acceleration/Action force and transferring forward the remaining 3 lb. of serial transfer force to the remaining 3 pavers. Paver 2 receives the 3 lb. combined force, terminates its 1 lb. of acceleration/Action force that is causing its acceleration and transfers forward a 2 lb.force. Paver 3 receives the 2 lb. combined force, terminates its 1 lb. of acceleration/Action force internally and transfers forward the remaining 1 lb.force. Lastly, Paver 4 receives the final 1 lb. of acceleration/Action force which terminates fully against its own Type 2 internal a/R forces leaving no action force left over to be transferred forward to objects beyond Paver 4.

(48) Notice how the rearward Type 2 internal a/R forces, from each accelerating paver, stack up in the direction of the scale. Paver 4 is freely applying the accumulation of its myriad of Type 2 a/R forces by a Type 3 bipole external stacking reaction force as the external 1 lb. force of its a/R weight against Paver 3. Paver 3 receives the 1 lb.force of Paver 4's a/R weight, adds the 1 lb.force of its own a/R weight and transfers the total of a 2 lb.force on back to Paver 2. Paver 2 receives the 2 lb.force, adds 1 lb. and transfers rearward a 3 lb.force. Finally, Paver 1 receives the 3 lb.force from Paver 2, adds the 1 lb.force of its own a/R weight and applies the total 4 lb. acceleration/Reaction force rearward against the scale. In this manner, the internal acceleration/Reaction force being reactively generated within each accelerating component of each paver's matter in support for acceleration plays a supporting role as the myriad of such forces stack up in the direction of the scale in reactive support for the external action forces being delivered forward by the accelerating scale.

Conclusion I

(49) When Type 3 external stacking forces are being transferred along a series of objects while the measurable forces present between the objects stack up in one direction along the series, then Type 2 internal stacking forces being actively or reactively generated in that same direction within the components of each object in the series are so indicated as being present. I see this understanding of Type 2 internal stacking forces joining forces with Type 3 external stacking forces as an important tool to add to our Force Investigation Toolbox.

(50) If you are somehow still clinging to the "net force" theory that our scale and 4 pavers are being accelerated forward by an acceleration/Action force because these 5 objects are experiencing no force in the rearward direction, then to you, I address the following thoughts designed to help rid your mind of the last vestiges of this merit-less theory. You must agree that the scale is transferring forward the acceleration/Action force responsible for causing acceleration for each of the 4 pavers. After all, this force represents the only force admitted as being present using the "net force" theory. Also you must agree, based upon Newton's LAW III that the

pressure between the scale and Paver 1 is a "mutual pressure" in that as much as the scale pushes forward against Paver 1, Paver 1 pushes rearward against the scale. Already the "net force" theory is in trouble for it does not provide for any rearward force from any of the accelerating pavers yet here we acknowledge the presence of a rearward force from Paver 1 that bears in a "mutual" manner against the scale. Moving forward 1 paver, you must agree that due to "mutual pressure", as much as Paver 1 is pushing forward against Paver 2, Paver 2 is pushing rearward against Paver 1. This means that there is a rearward force present against Paver 1. Again the presence of this rearward force is not accounted for by the "net force" theory. If you insert your small scale, you can measure the reality of the "mutual pressure" of the 3 lb.force between Pavers 1 & 2, and for that matter the "mutual pressure" of the 2 lb.force acting and reacting equally in opposite directions between Pavers 2 & 3, and finally the "mutual pressure" of the 1 lb.force acting and reacting equally between Pavers 3 & 4

(51) Yet even now you may be thinking that the forward-directed 1 lb.force causing the acceleration of Paver 4 is a "net" force since no rearward-directed force is thought to be having an effect on Paver 4's matter. But once you recognize that the stacking of forces effect is alive and well throughout Paver 4's matter as the forward-directed acceleration/Action forces stack down in their termination against each component's rearward-directed acceleration/Reaction force, you can clearly see that the "no rearward-directed force is effecting Paver 4's matter" belief is not supported by experimental fact and is therefore unreal.

(52) What is real here is that as much as every component of these 4 pavers is being accelerated forward by a portion of the bulkhead's acceleration/Action force, each accelerating paver component is pushing rearward with an equal acceleration/Reaction force. Increase the a/A force and the a/R force from the accelerating components increases in a proportional manner as proven by the force displays of the large and small scales. Decrease the acceleration/Action force and the component's a/R force decreases in a proportional manner. Cancel the acceleration/Action force and the component's a/R force is equally canceled leaving the component very close to the non-accelerative default state of rest-motion.

(53) The real obstacle to letting go of the "net force" theory is the belief that if a rearward force is present and reacting against the pavers then the bulkhead's forward action force will become balanced meaning that no acceleration can occur for the pavers. We have tested and proven the existence of a rearward-directed acceleration/Reaction force affecting each paver and the scale while their forward acceleration continues unabated. So this belief regarding the acceleration-canceling powers of a rearward-directed, internal, acceleration/Reaction force is a false belief. Consider that in every event involving acceleration, the rearward-directed force that is reacting in support to the acceleration/Action force is a Type 1 or Type 2 internal, acceleration/Reaction force that is monopole in nature meaning that, unlike bipole Type 3 and Type 4 forces, this monopole reaction force is able to reactively bear in the rearward direction in support of the event-causing acceleration/Action force without bearing in the forward direction against any other object. This means that the acceleration/Reaction force serves in no manner to reduce or cancel the activity being caused by the action force for that action force and its activity represent the very cause of the reaction force. Since it is not logical to expect that any force can serve in any manner to reduce or eliminate its own cause, then it is not logical to expect that an

object's acceleration/Reaction force can serve in any manner to reduce or eliminate its own acceleration/Action force cause. It is okay now for one to let go of the "net" force theory. It never was true, even at its peak of acceptance.

Conclusion II

(54) The mutual nature of force requires that each of us come to recognize and accept that every force is always opposed or supported by an equal force of one type or another, without exception. So says Newton's LAW III, so says the Universal Law of Mutual Forces, and so says our logic-based common sense.

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References

[1] Sir Isaac Newton, 1686, 1729, Mathematical Principles of Natural Philosophy and His System of the World, 1934, 1962, PRINCIPIA, University of California Press, Berkeley, Los Angeles, London, pages 2 - 13.

Author's Commentary

First of all, I would like to explain the reasons for the extensive length of Article IV. I have tried in the past to write these several concepts for force in an abbreviated format with no success. I feel that Isaac Newton's greatest mistake is that he devoted too few words to explaining his understanding of the concepts of inertia, acceleration, force, and time. I have tried in all of my articles not to repeat Newton's mistake. Instead, I have made a conscious effort to explain each understanding at least twice so that you, the reader, will have at a minimum, two perspectives to consider.

Pay particular attention to the four types of force presented in Article IV. They will prove quite helpful in analyzing Universal events, including the ones yet to be presented in subsequent articles (See Event 4: The Physics of a Tornado and Event 5: The Physics of Earth's Tides). For certain these four types of force will play an important role in Article VI where the supposed equality of a gravitational event to an accelerational event will be examined and set aside in favor of understanding the many differences that exist between the internal and external, acceleration/Action and acceleration/Reaction forces present during these two different non-equal events.

Until then, remember, Physics is for everyone.

Ethan Skyler

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