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Article I: The Reality of Newton's Inertia

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Purpose

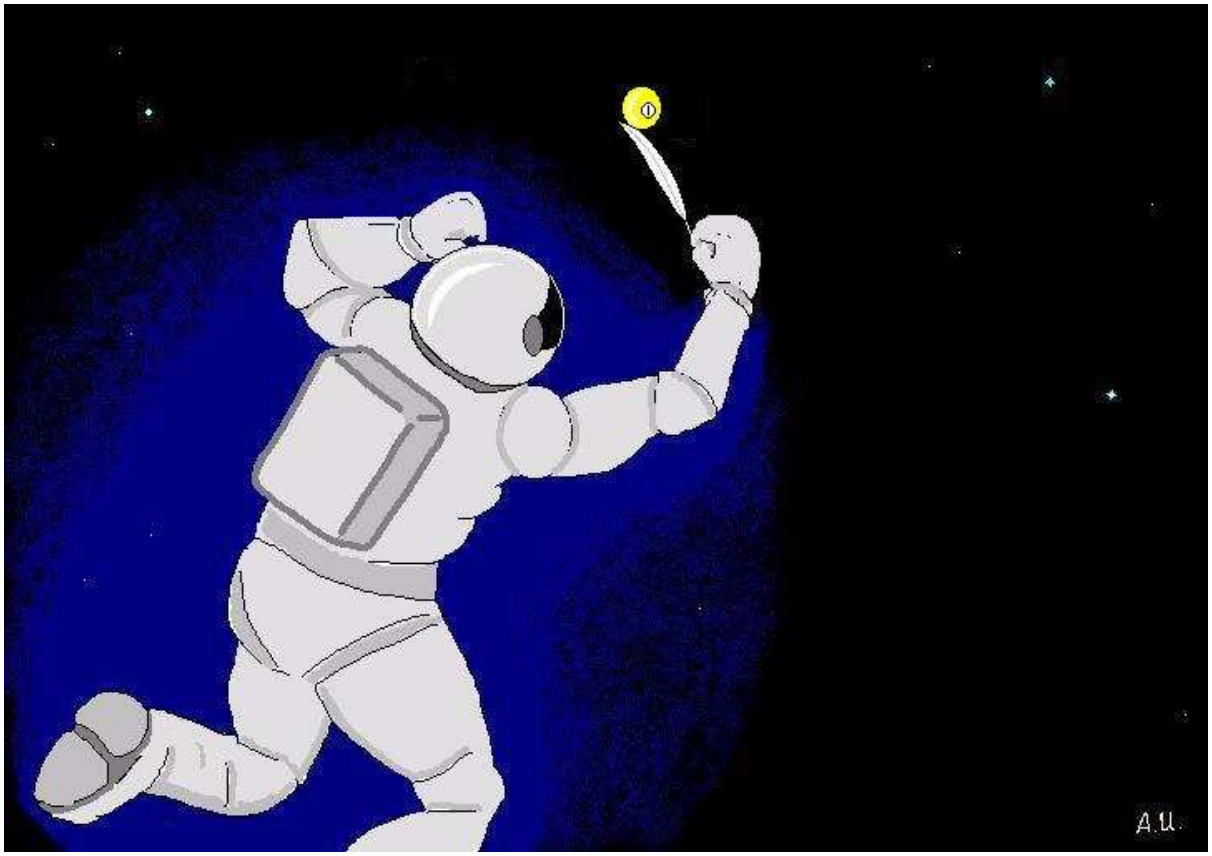
Isaac Newton made the Classical Mechanics concept of inertia the widely recognized Physical concept it is today. But in truth is inertia actually anything real? I have discovered that when one asks even a single question about the role of inertia during an event, the reality of inertia's existence immediately becomes shaded with doubt. My purpose in writing the following article is to answer the question: "Is inertia real or imaginary?"

Article I

In his great work, "Mathematical Principles of Natural Philosophy", known today more simply as "PRINCIPIA" [1], Isaac Newton described inertia as the "force of inactivity". He went on to say that an object maintained its state of rest, or uniform motion (same state) "by its inertia only." In other words "resting" and "uniformly moving" objects were viewed by Newton as being equally inactive and further that this inactivity was being maintained by the force Newton called "inertia". Thus, according to Newton's description, the object's "force of inertia" must serve in some manner to prevent activity from occurring to the object's state of motion if the object's "inactivity" is to be "maintained". With rest and uniform motion being the inactive state then a change in motion (acceleration) must be the active state that challenges the inactivity-maintaining power of the object's "inertia". Since the activity of acceleration is always caused by an accelerative force (Newton's LAW I), and further since every accelerative force always finds support against some other force of equal magnitude (Newton's LAW III), then it holds that Newton's inertia must be this other force that reacts in support of the accelerative force which is busy acting as the cause of the object's accelerational activity. (See references [2], [3], and [4]).

(2) But why then did Newton refer to inertia as being a "force of inactivity"? Clearly, any force that reacts in support for an acceleration-causing action force is itself a force that is a participant in the activity of acceleration. For certain, as long as the active acceleration force is present, the object will continue to accelerate with no end in sight. Therefore, in practice, any reactive inertia force directed back from the object does nothing to prevent the acceleration action force from continuing to cause acceleration for the object. In fact, it is clear that as long as the acceleration action force is impressed against the accelerating object, no force of any type is present that is successful in causing an end to the acceleration and thereby restoring the object once again to the non-accelerative inactive state of rest or uniform motion as Newton predicts is the true role of the object's inertia. In reality, during an accelerational event, I do not think there is any evidence of the presence of any "force of inactivity" that matches Isaac Newton's description for the role of inertia.

(3) In my next effort to discover the reality of Newton's inertia, I propose an experiment in the vacuum of the space between solar systems whereby a weightless billiard ball is maintaining a constant position before me, within arm's reach. If Newton's inertia is busy maintaining this ball's inactive state of motion, then how can it be that even the slightest push from the tip of a feather will immediately begin causing the ball to abandon its current state of motion for a new one? I think the answer is that there is nothing present that prevents the ball from accelerating away from my location in response to the force applied by the feather's tip. While it takes an action force to accelerate the ball in one direction and an oppositely-directed action force to accelerate the ball in the opposite direction, in the absence of either of these acceleration action forces, there is no force present at all, nor anything else, that is busy "maintaining" the ball's inactive state of motion. From my perspective, the ball before me is in the inactive state of rest.



(4) In fact, since it takes the presence of an action force to cause the billiard ball to accelerate away from its position of inactive rest before me (Newton's LAW I), in the absence of such an action force, what should one expect the ball to do in the meantime? Does the inactive ball not have but one available option? I see that solitary option is for the ball to continue waiting in the inactive state of rest until the next acceleration action force becomes present. If he were asked to consider this event, Isaac Newton would undoubtedly point to the inactive billiard ball before me and contend that the presence of the ball's "inertia" was the reason the ball's inactive state of motion was being "maintained". I would point back to Newton that according to his own,

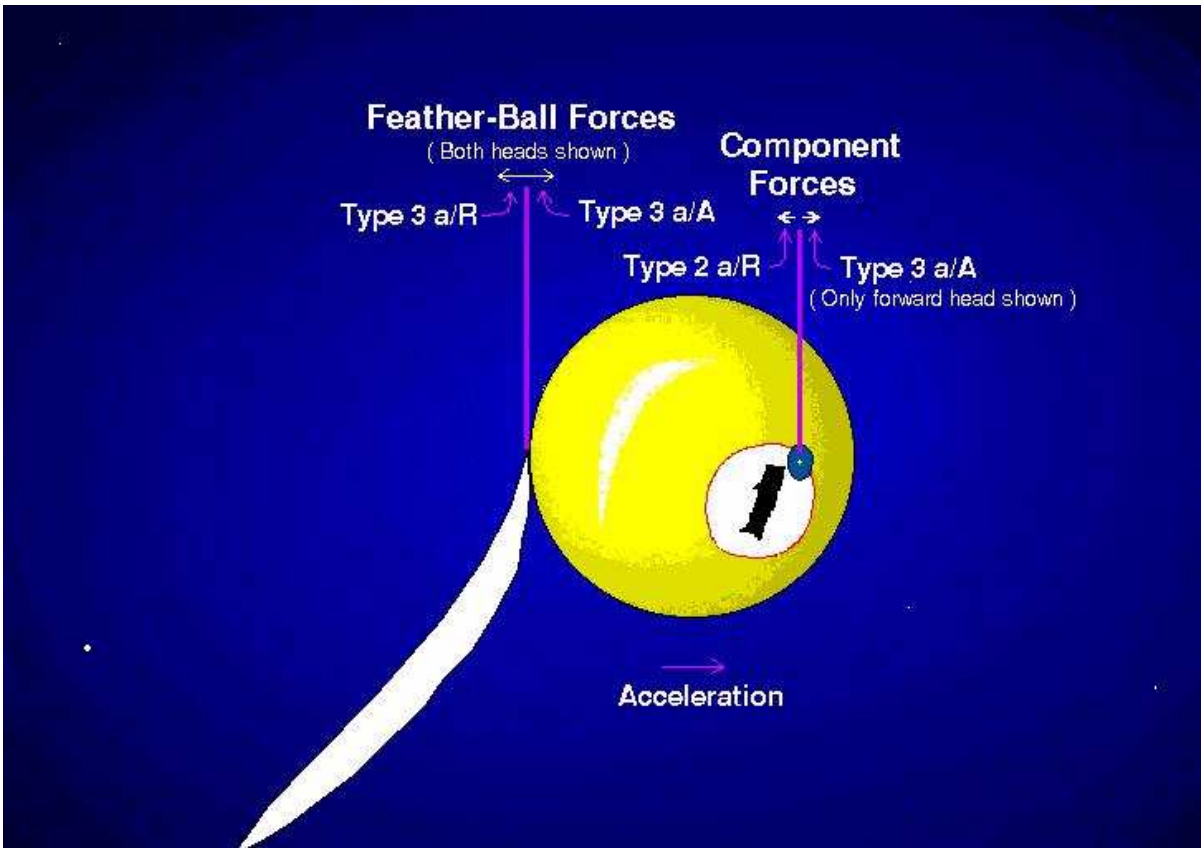
perfectly correct LAW I, since it takes an action force to cause acceleration for the object, the true reason the billiard ball remains in its inactive state of motion before me is due, not to his claim of the presence of the ball's supposed "inertia" but instead, to the absence of an acceleration-causing action force, as correctly predicted by LAW I.

(5) Since both Newton and I agree that it takes an action force to cause acceleration for the billiard ball, then if he were able to read this discussion he should agree with me that in the absence of such an acceleration-causing action force, the billiard ball has no other option but to remain in its current inactive state of rest-motion until such time as the next action force comes along. At this point it should be clear, even to Newton, that the only condition required for a resting object to continue resting, indefinitely, is for all action forces to be either absent or in balance with each other. Clearly "inertia" has no role to fill in this event regardless of whether the object's state of motion is active, as when an acceleration/Action force is present, or inactive as when an acceleration/Action force is absent. Once again, the role of Isaac Newton's "inertia" is the role of nothing.

(6) What then do today's educators teach us about inertia? Generally inertia is said to be a property of matter whereby the matter's inertia resists any force causing a change in its motion. Now, I see the word "resist" as interchangeable with "oppose" and the phrase "change in its motion" as interchangeable with "acceleration". Substituting these clearer words, we now have matter's inertia opposing any force causing acceleration for the matter. Since acceleration can only be caused by an action force (Newton's LAW I) and since any such acceleration/Action force is always opposed by an equal force (Newton's LAW III), this means that in order for the matter's inertia to present opposition to the acceleration/Action force, it must itself be a force, measurable in pound.force (lb.f) or the Newton (N).

(7) These considerations present a real problem for the reality of "inertia" which is today professed to not be a force at all, and not measurable in any distinct units of measure for "inertia", certainly not in lb.f. or the Newton. Furthermore, the acceleration force applied by the feather against the weightless billiard ball in deep space is said to be the only force experienced by the ball's matter. Thus it is professed in Modern Physics that the acceleration force from the feather is a "net force" or "single force" or "overall force" or "unbalanced force" that is predicted to act upon the ball in the complete absence of an equal and opposite force affecting the ball's matter. In support of this "net force" position we are asked to consider that no force is pushing back on the other side of the ball. Yet what of Newton's LAW III that predicts that, without exception, every force is always opposed by an equal force?

(8) Let us stop for a moment to take stock on this issue. When the billiard ball is accelerating in one direction by the acceleration/Action force from the feather, do you really think the ball's matter is not experiencing an equal force in the opposite direction? Or do you think, as I, that the bending aside of the feather's tip is a visual indication of the presence of equal and opposite forces, one of which is a backward reaction force that is being generated deep within each component of the matter of the accelerating ball? After all, how can one possibly push with any force at all against an object, accelerating or not, that does not push back with an equal force?



(9) Understand that this backward reaction force from the accelerating billiard ball that is presented against the feather's tip currently holds a discounted role during this event. The widely accepted Action/Reaction Force Rule defines each force of an action/reaction pair of forces as affecting a different object and therefore neither force is accepted as acting or reacting to cancel the effect the other force has upon one of the objects. Based upon this rule, physicists currently ignore the backward reaction force from the billiard ball because they only accept that it is affecting the feather. Thus they must think that this reaction force just suddenly appears at the contact point between the ball and the feather if they do not accept that it is also present at various lesser magnitudes throughout the ball's matter. This limited path of logic leads them to think that there is but one force being experienced by the ball, with this force being the forward acceleration action force from the feather. By this logic, today's physicists conclude that the ball is experiencing a forward-directed "net force" or "unbalanced force" from the feather since, in this frictionless environment, they do not recognize the presence of any rearward-directed force that is acting or reacting within the matter of the accelerating ball.

(10) But is this popular "net force" or "unbalanced force" position, regarding the forces affecting the ball, actually correct? Suppose I use a second billiard ball that has been previously sliced in two with each flat surface of each half attached to the opposing ends of a short, large diameter, open-coil compression spring. Next suppose I set aside the feather and instead apply a somewhat greater forward-directed acceleration action force with my finger against the middle of the curved

part of the back half of the ball causing forward-directed acceleration for the back half. This back half will subsequently apply a forward-directed acceleration action force that is transferred by the compression spring to the front half of the ball causing forward-directed acceleration for the front half. Now, according to Newton's LAW III, (neglecting the matter of the spring) as much as the back half is pushing forward with an action force on the ball's front half, the front half is pushing rearward with a reaction force on the ball's back half. Here I have established the presence of a rearward reaction force upon the back half of the accelerating ball, as experimentally validated by the visual reduction in the length of the compression spring between the ball's two halves. If the front half of the ball is also sliced in half in a direction parallel to the first slice and another compression spring is inserted, another rearward reaction force on another portion of the ball's matter is also established as being present, and so on until the forward-most atom of the ball's matter is reached. Even here, as much as the forward-most atom is accelerated forward by the last of the push of the acceleration/Action force from my finger, the atom pushes rearward with its own equal and opposite acceleration/Reaction force. Thus there is no point within the accelerating billiard ball where the remaining portions of the forward-directed action force from my finger are not equally opposed by the rearward-directed reaction forces being transferred rearward from the remaining portions of the ball's accelerating matter. Slicing the ball just helps us to see this truth. Accordingly, the "net force" conclusion regarding the predicted absence of any rearward-directed forces experienced by any portion of the ball's matter is a conclusion without merit. The same may be said for the Action/Reaction Force Rule (see Article V) for it truly is a misleading and therefore meritless "rule". I think its continued use is a hindrance to correctly understanding the true action and reaction forces present during an object's acceleration.

(11) Regarding "inertia", at this point in our discussion, "inertia" is nothing at all. Since it takes nothing to maintain a resting object at rest, then there is no role for "inertia" here. Also if "inertia" is not a real, measurable, variable, reactive force of support present during the activity of acceleration, then there is no role during acceleration for inert "inertia" to fill.[5]

(12) What then is the truth? It is clear that Newton's "inertia" is nothing. As nothing, "inertia" has no role in Physics for nothing is required for an object observed in the inactive state of rest to remain at rest, forever. Equally so, if you have trouble recognizing that rest and uniform motion are the same inactive state, then nothing is required for an object observed in the inactive state of uniform motion (in a straight line) to remain in uniform motion, forever. Also, regarding acceleration, while there are measurable, variable acceleration/Reaction forces present that provide support for the activity of a measurable, variable acceleration/Action force, classical mechanic's non-variable, forceless "inertia" is not one of them, nor is "inertia" one of anything else. "Inertia" is truly nothing at all. As with the Emperor's fabled suit of clothes, "inertia" is purely imaginary.

(13) Galileo Galilei, Isaac Newton's predecessor, is often given credit by science authors as being the first to recognize "inertia". Now that we recognize the non-reality of "inertia", one has to wonder if Galileo made the same error as did Newton. A thorough reading of Galileo's work has not revealed any evidence that he "discovered" or named "inertia". Just as in Newton's LAW I, all Galileo did was note that given the absence of an action force, an object had no choice but to continue on with its inactive state of rest or uniform motion unaltered or conserved. In the words

of Professor Stillman Drake, a noted authority on the life and work of Galileo, "Galileo never asserted any vis inertiae or "force of inactivity" as Newton did." In his discussion of the issue, Drake went on to say "Many blame Galileo for his inability to invent inertia-..." [6]

(14) Today we understand the truth and are able to credit Galileo with clear and logical thinking for he long ago recognized that which has long since been forgotten. The converse of Newton's LAW I predicts the truth that Galileo understood. If it always takes an impressed force to change an object's inactive state of motion (rest, uniform motion) into the active state of acceleration, then as long as such an impressed action force is absent, no change can possibly occur to the object's inactive state of motion for the object has no other choice but to wait in its inactive, default state (rest, uniform motion) until the next acceleration-causing action force becomes present. I find it curious that Newton did not recognize the converse of his own LAW I. He truly did miss this point since he professed in PRINCIPIA in Definition IV that an object "maintains every new state it acquires by its inertia only." [4] In other words Newton thought the presence of "inertia" was required in order for an inactive object to remain inactive. Instead, the converse of Newton's LAW I predicts the truth in that the absence of an acceleration action force is the only requirement that need be met in order for an inactive object to remain in an inactive, unaccelerated state of motion... forever.

(15) A historically significant event occurred when Newton's imaginary "inertia" was accepted as defined. This misguided effort of Newton's effectively replaced the most excellent work of Galileo on the matter of establishing the cause of the continuation of an object's uniform motion. For centuries Aristotle's position on this matter held firm as he had predicted that a "mover" was present as the cause of the continuation of an object's uniform motion. Galileo overturned Aristotle's unprovable and illogical "mover" when he pointed out that when no force was present to cause a change in an object's uniform motion then no change could possible occur. Thus a uniformly moving object, unable to change its motion by any other technique than with the presence of an acceleration action force, was left with no other choice but to continue on in an inactive manner with its uniform motion unchanged or unaccelerated. Later when Newton defined "inertia" and wrote that the object "maintains every new state it acquires by its inertia only", he breathed new life into Aristotle's abandoned "mover" as he effectively renamed it "inertia" and predicted that its presence was the cause of the continuation of an object's uniform motion. In this manner, Galileo's true work was set aside in favor of Aristotle's faulty work after having been unwittingly restored and renamed by Isaac Newton.

(16) In truth we now recognize that there exists no cause for the continuation of an object's uniform motion. Since no cause exists, no true explanation of cause is necessary or even possible. The object is in the inactive and causeless default state of rest-motion. It is when the object is in the active state of acceleration that a forceful cause becomes present and in need of explanation. Galileo expressed his recognition of this truth long before Newton's time. Now that we know the strength of Galileo's enduring genius let us not wait too long before setting the record straight.

(17) In honor of Galileo Galilei, The First Scientist [7], I hereby propose the banishment of all use of the imaginary term "inertia" from the writings and discussions of the mechanical concepts of Universal Physics. Accordingly, non-accelerating objects and non-accelerating frames of

reference shall replace "inertial" objects and "inertial" frames of reference while conversely, accelerating objects and accelerating frames of reference shall replace "non-inertial" objects and "non-inertial" frames of reference in all true scientific writings.

Ethan Skyler

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, page 2 - 13.

[2] 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.

[3] 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.

[4] For a body maintains every new state it acquires by its inertia only.

[5] Endless hours of discussion with my son, Ryan Skyler, have helped me to fully develop the "inertia" replacing concept of matter's acceleration/Reaction force. He was instrumental in getting me to cease trying to salvage the inert term "inertia" making room in my mind for its real-world, acceleration/Reaction force replacement. I have yet to find a keener mind on this subject than Ryan's. I am blessed to have his brilliance and original insight readily available. His contributions have influenced the development of many of the concepts of the new science Universal Physics. We are all in debt to his challenging support. Thank you, Ryan!

[6] Galileo Galilei, 1638, Two New Sciences Including Centers of Gravity and Force of Percussion, Translated, with a New Introduction and Notes, by Stillman Drake, 2nd Edition, Wall & Thompson, Toronto, page xxxii.

[7] For an excellent presentation and analysis of the abuse that was heaped, without mercy, upon Galileo, Our First Scientist, read "The War on Galileo" by Ronald Bruce Meyer.

Author's Commentary

One might wonder, with Newton's "inertia" absent, where will we go from here. Well, first of all, understand that the removal of "inertia" is not the removal of "something" from Physics, it is the removal of "nothing". It is most likely that the illusion of "inertia" has been concealing from our eyes the reality of a solid, practical, logical concept regarding force that has been all but ignored up to now.

One thing is for certain. Any science that embraces an imaginary concept as real and true is in serious trouble, for nothing that is subsequently based upon the imaginary concept can, itself, be true. Isaac Newton was confused about the reality of "inertia". The Modern Physic's version of "inertia" is no improvement. Continued use of Newton's imaginary "inertia" has polluted the

remaining concepts of Classical Mechanics. Albert Einstein fared no better for he carried forward Newton's imaginary "inertia", whole and intact, into the imaginative thought experiments of Relativistic Mechanics. This simple act of faith on Einstein's part does not bode well for the future of Relativistic Mechanics.

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