

BRK-001 · Motion without a continuous mover

BRK · Conceptual Breaks

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A stone leaves a hand, continues through the air and eventually falls. What requires explanation: its continued movement, its slowing, its downward turn, or all three? The observations do not by themselves choose the question. Different theories assign different roles to the same visible sequence.

One important change in the history of mechanics concerned the persistence of motion. A moving body eventually ceased to require a continuously operating mover merely to maintain a uniform straight trajectory. Interactions instead became necessary to explain changes in that trajectory. This was not a single discovery extracted from watching an object glide. It involved competing accounts of cause, resistance, natural motion and the geometry of an undisturbed path.

1. Why a projectile was a difficult case

An externally pushed object presents a comparatively simple causal picture while the push continues. A projectile complicates that picture because contact with the thrower ends before its motion ends. An explanation that requires a proximate mover must identify what continues to do the moving.

One historical answer assigned a role to the surrounding medium. Buridan's discussion rejected an air-driven account of projectile persistence and located a motive quality in the projectile itself. As Jack Zupko's study explains, this was a modification within a

much wider Aristotelian intellectual setting, not an abandonment of that setting in every respect. [1]

That qualification changes the history. Medieval discussion was not simply an empty interval between Aristotle and modern physics. Nor was there one unchanging “medieval view” against which a later scientist could make a single decisive observation. Theories could share a causal vocabulary while disagreeing about where a cause resides and how long it acts.

2. Impetus changes the location of the cause

In Buridan’s account, the thrower impresses impetus in the projectile. The impetus can sustain motion after separation from the hand. Resistance and an inclination to contrary motion can diminish it. His formulation allows persistence without an intrinsic requirement that impetus expire merely because time passes. [1]

This was a substantial explanatory possibility. If an object slows, one can ask which opposing factors diminish what was imparted, rather than assume that separation from the mover must itself terminate motion. The account also associates impetus with the speed and quantity of matter of the body. [1]

It is tempting to translate that association directly into modern momentum. That would claim more than the evidence warrants. Similar verbal dependence does not establish an identical mathematical quantity, a vector conservation law or the same rules for interactions. Buridan’s impetus remained a motive quality doing causal work inside a different conceptual system.

The contrast is therefore not simply “external force” followed by “internal force” followed by the correct answer. Moving the proposed cause inside the body solved one problem while

retaining another: continued motion was still explained through a possessed motive principle. An inertial formulation would alter the demand for such a cause.

3. Persistence does not yet specify the path

Even after allowing motion to persist, one must say what counts as its undisturbed continuation. Straight and circular persistence are not interchangeable. A body moving at constant speed in a circle continually changes its direction. In modern mechanics, that change requires acceleration.

Historical formulations did not begin with that entire modern framework already in place. Descartes's first two laws in the *Principles* distinguish persistence in a state from the rectilinear character of motion. Scholarship contrasts this explicit straight-line formulation with forms of circular persistence associated with Galileo and Beeckman. The comparison must not turn every Galilean discussion into Newton's later first law. [2]

A useful modern diagnostic, not a quotation from these authors, is to imagine removing the constraint on an object traveling in a circle. Does the proposed free continuation preserve its circular path, move radially outward, or proceed along the tangent? These are different predictions and require different analyses of what the constraint was doing.

Descartes's own treatment of circular motion and bodily tendencies was more complicated than a modern textbook version of inertia. His account of centrifugal effects and his collision rules should not be silently repaired before evaluating his contribution. A framework can contain a powerful new distinction while also retaining consequential errors. [2]

4. What becomes the explanatory default

The conceptual shift is clearest when we compare two questions. “What sustains the body’s uniform motion?” invites a sustaining agency. “What changes the body’s motion?” permits uniform motion to be a default state, subject to the conditions of the chosen frame and theory.

This does not make causes disappear. It reallocates their work. Starting, stopping, changing speed and changing direction require accounts of interaction. The persistence of velocity does not require a further force in the same way. The resting object and the uniformly moving object can then be analyzed within one dynamical scheme.

The modern relation $F = ma$ expresses that allocation for constant mass in an inertial frame, with F the net force and a the acceleration. It is included here only to clarify the endpoint of the conceptual comparison. It is not presented as Buridan’s equation, Descartes’s formula, or a summary of the experimental route by which later mechanics was established.

An ordinary object sliding on a table does not display the force-free limit: contact forces and resistance matter. Seeing it stop therefore does not refute inertia. But neither does imagining a frictionless surface constitute an experimental demonstration on its own. The idealization becomes scientifically useful through its fit within a wider system of measurable interactions and predictions.

5. Continuity without an invented chain of transmission

The sequence of ideas is not evidence for a simple relay from Buridan through Galileo to Newton. A later argument can resemble an earlier one without direct transmission; an author can know an earlier text while transforming its central assumptions.

Establishing influence requires documents, not only conceptual similarity.

Zupko explicitly cautions against making Buridan a straightforward precursor of Galileo. The account of Descartes likewise shows how a new law could use argumentative resources inherited from scholastic philosophy. These examples resist both a story of total discontinuity and a story in which modern mechanics was already present in medieval terminology. [1,2]

What changed was the structure of the explanatory problem. Persistence became distinguishable from externally sustained activity; rectilinearity became a substantive condition; and resistance could be investigated as an interaction rather than treated as the inevitable exhaustion of motion itself.

6. The problem left behind

Once undisturbed motion is a default, identifying the conditions under which that default applies becomes essential. We must distinguish frames, constraints and interactions. The achievement opens questions about how ideal laws connect to measurements in a world full of friction and acceleration.

The rupture was therefore neither the discovery that objects sometimes keep moving nor a victory of one person over universal confusion. It was a reorganization of what needed a cause, what counted as the relevant state of a body, and which departures from that state could be investigated. Those changes made a different kind of dynamical explanation possible.

Related reading

BRK Article 005, “Geometry no longer has one inevitable form,” examines another change in what may be assumed and what must be demonstrated.

References

- [1] Zupko, J. “John Buridan.” *Stanford Encyclopedia of Philosophy*, section on natural philosophy and impetus. <https://plato.stanford.edu/entries/buridan/>
- [2] Slowik, E. “Descartes’ Physics.” *Stanford Encyclopedia of Philosophy*, sections on the laws of motion and bodily forces. <https://plato.stanford.edu/entries/descartes-physics/>