

# **Philosophy 203**

## ***History of Modern Western Philosophy***



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**Class #12**  
**Leibniz and Newton on Space and Time**

# The Problem of Contingent Truths

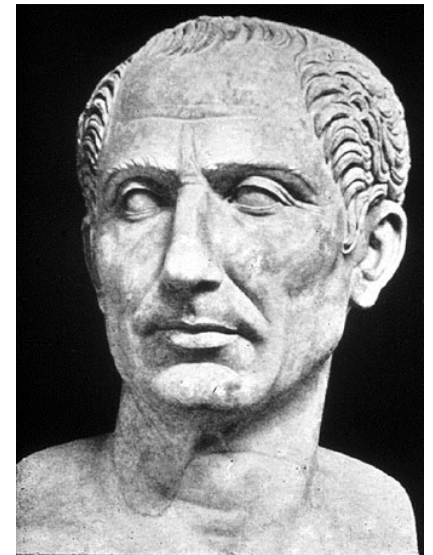
- Spinoza denied that any events were contingent.
  - God instantiates every possibility.
- Leibniz thinks that there are other possible worlds.
  - The existence of this world is contingent on our free choice.
  - For some actions, I could have done otherwise.
- But, Leibniz holds that nothing happens without sufficient reason (PSR).
  - PSR entails that God has foreknowledge of all of our actions.
  - Any truth can be discovered by analyzing the complete concept of a substance into its component parts.
  - By analysis, we will either find a given predicate inside the original concept, or find a contradiction arising from that predication.
  - Either a property is true of a substance or it is not, both in the future and in the past.
- There seems to be no room for free choice, for denying that one can act other than one does, that the world can be other than what it is.

# Three Hints

1. While Leibniz states that this is the best of all possible worlds, he does accept that such other worlds are possible.
2. Contingent claims can be discovered only by infinite analysis, while necessary truths are discoverable by finite analysis.
3. Leibniz distinguishes between certain truths and necessary ones.
  - ▶ “Everyone grants that future contingents are certain, since God foresees them, but we do not concede that they are necessary on that account” (D13, AW 230b).
  - ▶ God knows that Caesar will cross the Rubicon, but it’s still Caesar’s choice.

# Julius Caesar

“If someone were able to carry out the whole demonstration by virtues of which he could prove this connection between the subject, Caesar, and the predicate, his successful undertaking, he in fact be showing that Caesar’s future dictatorship is grounded in his notion or nature, that there is a reason why he crossed the Rubicon rather than stopped at it and why he won rather than lost at Pharsalus and that it was reasonable, and consequently certain, that this should happen. But this would not show that it was necessary in itself nor that the contrary implies a contradiction... For it will be found that the demonstration of this predicate of Caesar is not as absolute as those of numbers or of geometry, but that it supposes the sequence of things that God has freely chosen, a sequence based on God's first free decree always to do what is most perfect and on God's decree with respect to human nature, following out of the first decree, that man will always do (although freely) that which appears to be best. But every truth based on these kinds of decrees is contingent, even though it is certain; for these decrees do not change the possibility of things...it is not its impossibility but its imperfection which causes it to be rejected. And nothing is necessary whose contrary is possible” (D13, AW 231b).



# Certainty and Necessity

- “The one whose contrary implies a contradiction is absolutely necessary; this deduction occurs in the eternal truths, for example, the truths of geometry. The other is necessary only *ex hypothesi* and, so to speak, accidentally, but it is contingent in itself, since its contrary does not imply a contradiction. And this connection is based not purely on ideas and God's simple understanding, but on his free decrees and on the sequence of the universe” (D13, AW 231a).
- It is certain that I have two children; God can see that fact.
- But, it is not necessary that I have two children, since this fact depends on my free choice.
- “It is not impossible for what is foreseen not to happen; but it is infallibly sure that it will happen” (*Theodicy* ~407).

# Possibility and Compossibility

- It looks to us as if the world which is just the same as it is, except that Hamilton College is located on a small Caribbean island with fruited mango trees and sea breezes on campus all year around, is possible.
- But, Leibniz argues, to make even one change in the world entails changing other factors in that world.
- What seems possible in itself may not be compossible with other changes that moving Hamilton would entail.



# Compossibles and Counterparts

- Recall Leibniz's complete-concept view of the monad.
- If Hamilton were located in the Caribbean, none of us would be members of its community.
  - There would be people somewhat like us attending and teaching at that school.
- We do not know what other properties of those people would have to be different from us in order to construct a system of compossibilities.
- We could call the people in the Caribbean-Hamilton world our counterparts, but they would not be us.
  - "These worlds are all here, that is, in ideas. I will show you some, wherein shall be found, not absolutely the same Sextus as you have seen (that is not possible, he carries with him always that which he shall be) but several Sextuses resembling him, possessing all that you know already of the true Sextus, but not all that is already in him imperceptibly, nor in consequence all that shall yet happen to him. You will find in one world a very happy and noble Sextus, in another a Sextus content with a mediocre state, a Sextus, indeed, of every kind and endless diversity of forms" (Theodicy, ~416).

# Counterparts and Trans-World Identity

- Do we exist in other possible worlds?
  - Saul Kripke: We stipulate other possible worlds.
  - Names are rigid designators.
- Or, do we merely have counterparts there?
  - David Lewis: There are counterpart relations among me and all my dopplegangers in other possible worlds.
  - Exploring the nature of other possible worlds involves specifying those counterpart relations.
  - We might identify our selves with the set of our counterparts: embracing our mathematical essence!



# Axioms of Counterpart Theory

C1.  $(\forall x)(\forall y)(lxy \supset Wy)$

- worlds are the containers of objects

C2.  $(\forall x)(\forall y)(\forall z)[(lxy \cdot lxz) \supset y=z]$

- individuals can only exist in one world

C3.  $(\forall x)(\forall y)[Cxy \supset (\exists z)lxz]$

C4.  $(\forall x)(\forall y)[Cxy \supset (\exists z)$

- all counterparts exist in worlds

C5.  $(\forall x)(\forall y)(\forall z)[(lxy \cdot lzy \cdot Cxz) \supset x=z]$

- there are no distinct counterparts in any given world

C6.  $(\forall x)(\forall y)(lxy \supset Cxx)$

- a thing is the counterpart of itself

C7.  $(\exists x)[Wx \cdot (\forall y)(lyx \equiv Ay)]$

- there is a world which contains all and only actual things

C8.  $(\exists x)Ax$

- the actual world exists

$Wx$ : x is a world

$lxy$ : x is in world y

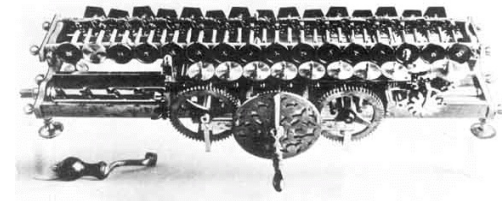
$Ax$ : x is actual

$Cxy$  x is a counterpart of y

# Infinite Analysis and Finite Analysis

- In a finite analysis, we can unpack a complex concept until we reach what Leibniz calls an identity statement.
  - $3^2 = \sqrt{81}$
  - $3 \times 3 = 9$
  - $3 \times 3 = 3 \times 3$
  - Later, we will call such claims analytic truths.
- Similarly, given a false statement, we will arrive at some kind of contradiction by analysis.
- Consider: 'Russell has two children'.
  - According to the doctrine of conceptual containment, my concept contains my having two children.
  - Nevertheless, there are possible worlds in which I don't have two children.
  - Correspondingly, when we analyze the concept 'Russell', we will not be able to unpack the claim that I have two children.
  - God could do so, but we can not.

# Leibniz's Achievements



Mathematical (calculus, adding machine)

The concept of possible worlds and its utility for dealing with modality

- Necessity and possibility
- Modal logic
- Kripkean semantics (stipulation)
- Lewisian semantics (counterpart theory)

Analysis

- Frege, Russell, Logical Wittgenstein,
- Logical empiricism (positivism)

The primacy (irreducibility) of our mental lives

- More than Descartes, actually

Relationalism about space and time



# Absolute and Relational Notions of Space and Time

- Theories of space and time have their roots in our observations about change.
- Change is due to some sort of motion.
- Motion is ordinarily measured relative to some external object.
  - Traveling on the highway, I am moving, with respect to the world outside the car, and sitting with respect to the car itself.
  - The Earth itself is moving, spinning on its axis.
  - The axis of the Earth is shifting in the annual revolution of our planet around the sun.
  - The solar system is moving relative to our Milky Way Galaxy, and the Milky Way is moving within our local system of galaxies.
  - I am driving 50 mph west, while the Earth is spinning at 650 miles per hour East, and the whole system is flying through space in its revolution around the sun at around 66,000 miles per hour, etc.
- Is there some fixed point, some privileged reference frame, to which all motion can be measured?
- Is there an absolute sense in which we can be said to be moving or not?
- Can we measure this motion relative to some special body or substance, like absolute space?
- Is there space, in addition to places?

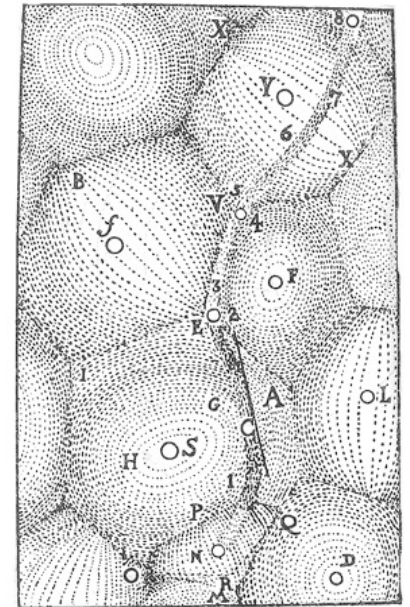
# Newton and Leibniz

Do space and time have absolute reality, or are they merely relational concepts?

- Newton's view is absolutist.
  - Space is something distinct from the bodies that occupy it.
  - Time is something that passes uniformly without regard to events in the world.
  - Space is an empty container, and time marches inexorably forward.
  - Though we measure space and time using bodies and events, these are only indicative of relative motions.
- Leibniz is a relationalist
  - Space and time are idealizations.
  - They are abstractions from the realities of the material world.
  - "I hold space to be something merely relative, as time is...an order of coexistences, as time is an order of successions" (LIII.4, AW 297b).

# Cartesians and the Void

- Descartes's physics denied the possibility of a void, or vacuum.
  - Aristoteleans who believed that a void is nothing, and what is nothing does not exist.
- Descartes took the world to be a plenum, in which space is not distinct from the bodies which fill it.
  - “All places are full of bodies... Each body can move only in complete circle of matter, or ring of bodies which all move together at the same time: a body entering a given place expels another, and the expelled body moves on and expels another, and so on, until the body at the end of the sequence enters the place left by the first body...” (Descartes, *Principles of Philosophy*, II.33).
- Leibniz adopts Descartes's views on the completeness of the material world.
  - “Let us fancy a space wholly empty. God could have placed some matter in it without derogating, in any respect, from all other things; therefore, he has actually placed some matter in that space; therefore, there is no space wholly empty; therefore, all is full” (LIV.PS, AW 303a).
- The Cartesians defined motion in terms of the translation of a body relative to its surrounding objects in the plenum.



# Atomists and the Void

- Gassendi, the intellectual heir of the Greek atomists, had argued that the places between objects are empty.
- Objects are placed in a transcendent void.
- When we move, we change our place relative to the objects around us, and we change our location in absolute space.
- “What exists outside the universe?”
  - Leibniz, with the Cartesians, answers that the universe extends infinitely, so that there is no outside.
  - Newton, with the atomists, answers that there is an empty void.
- Today, the debate between relationalist and absolutists continues between space-time relationalists, who believe that space-time is an artificial, or nominal, construct out of particular bodies, and substantivalists, who believe in the existence of space-time points or regions.

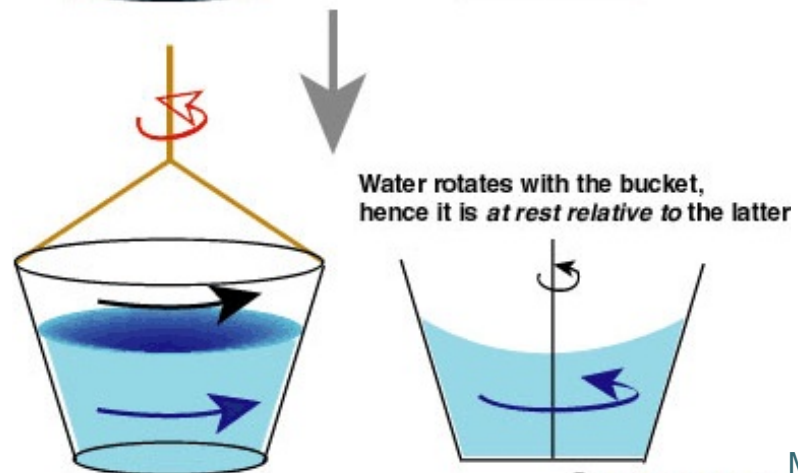
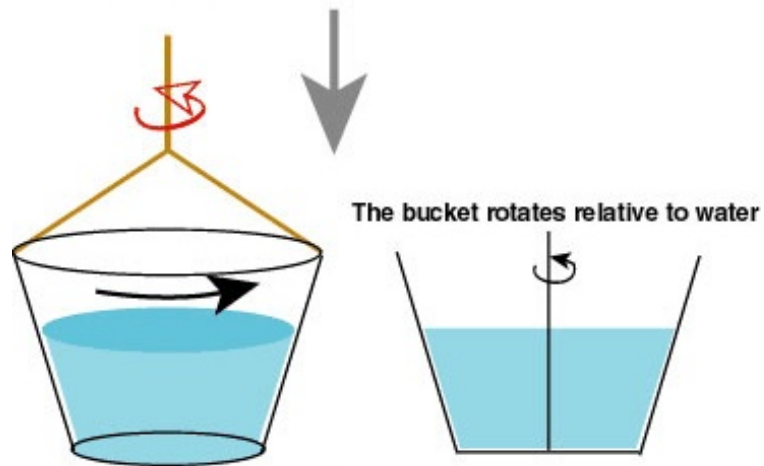
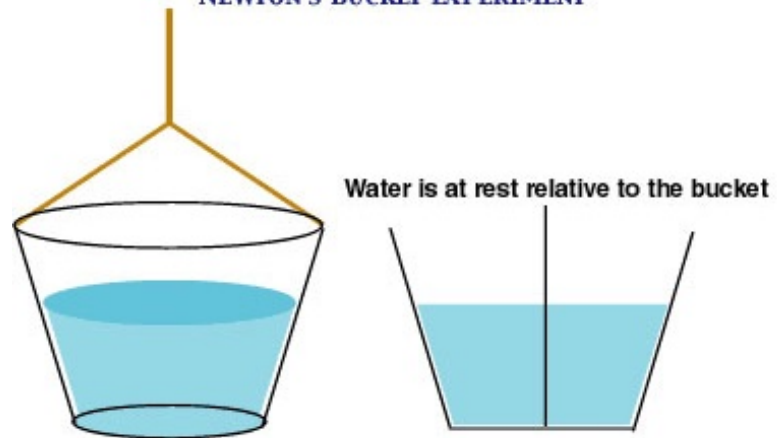
# Newton's Views on Space and Time

- Absolute time passes steadily without relation to anything external, and thus without reference to any change or way of measuring of time.
- Absolute space remains without relation to anything external.
- Relative spaces are measures of absolute space defined with reference to some system of bodies; a relative space may be in motion.
- The place of a body is the space which it occupies, whether absolute or relative.
- Absolute motion is the translation of a body from one absolute place to another; relative motion is the translation from one relative place to another.
- Thus, space is distinct from, and exists independently of, bodies.
- It is logically and metaphysically prior to bodies and events among bodies, in that bodies require space but space need not include any bodies.
- There is a fact of the matter whether a given body moves and what its true quantity of motion is.
- The true motion of a body does not consist of, or cannot be defined in terms of, its motion relative to other bodies.<sup>1</sup>
- Space is the sensorium of God, the seat of divine cognition.

# Arguments from Properties and Causes

- Newton argues that the definition of motion as translation of a body relative to its surrounding objects will not allow us to arrive at a measurement of absolute motion.
- Bodies that are truly at rest are at rest with respect to one another.
  - Imagine that there is a distant star which is absolutely at rest.
  - We might wonder if something in our vicinity is also at rest.
  - But, if we measure it relative to the motions of things around it, we can not know whether it is moving or at rest relative to the distant star.
  - Thus, true rest cannot be defined simply in terms of position relative to bodies in the vicinity.
- If a part of a body maintains a fixed position with respect to the body as a whole, then it participates in the motion of the whole body.
  - Imagine that I am sleeping in the back of the car.
  - My femur is at rest with respect to me.
  - I am at rest with respect to the car.
  - But, my femur and I are both moving.
  - Thus, absolute motion cannot be defined as a translation from the immediately surrounding bodies.
- A body participates in the motion of its place when it moves away from that place.
  - You can change the relative motion of a body by changing the motion of the bodies to which you are comparing it.
  - But, you can only change the true, or absolute, motion of a body by applying some force to it.
  - The absolute motion of a body cannot be defined except by means of stationary places.

## NEWTON'S BUCKET EXPERIMENT



# Newton's Bucket

- We know that the motions are different in the two states, but we can not differentiate them in terms of local changes of place.
- In both state 1 and state 3, the water and the bucket are at relative rest.
- But state 3 is measurably different to state 1.
- The relationalist seems unable to describe the difference between the two states.
- The absolutist needs merely to point out that in state 3, the system is in absolute motion, while in state 1, the system is at absolute rest.

# Measuring Velocity

- The absolute speed of a body is the rate of change of its position relative to an arbitrary point of absolute space.
- According to Newton's account, absolute velocity is a well-defined quantity.
- But consider, as Galileo did, riding in a ship at a constant velocity.
- We cannot determine from observations inside the cabin whether the boat is at rest in harbor or sailing smoothly.
- Absolute velocity cannot be experimentally determined, unlike absolute rotation.
  - "Yet the thing is not altogether desperate; for we have some arguments to guide us, partly from the apparent motions, which are the differences of the true motions, partly from the forces, which are the causes and effects of the true motions" (Scholium to Definitions in *Principia*, AW 288a).

# Leibniz, Against Newton

- “Our dispute consists in many other things. The question is whether God does not act in the most regular and most perfect manner; whether his machine is liable to disorder, which he is obliged to mend by extraordinary means; whether the will of God can act without reason; whether space is an absolute being; also concerning the nature of miracles; and many such things, which make a wide difference between us” (LIII.16, AW 299a).
- We are focusing only on the question of whether space is relational or absolute.

# Classifying Space

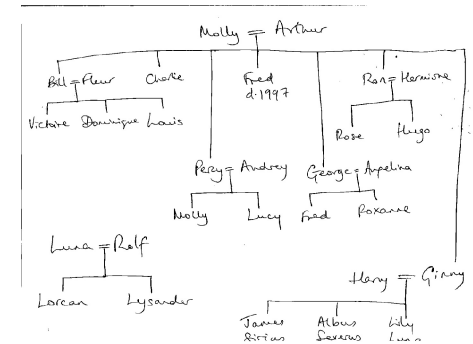
Is it a substance or an attribute?

- Newton does not take space to be a substance, for it lacks causal powers.
- But, it is also not an attribute, since its existence transcends the existence of any things.
- Unlike, say, redness, it doesn't need a thing to be predicated of.
  - “If space is a property or attribute, it must be the property of some substance. But of what substance will that bounded empty space be an affection or property, which the persons I am arguing with suppose to be between two bodies?” (LIV.8, AW 300a).
- So, space is real, but hovers in between substance and attribute.
- Perhaps the classification of all objects into substances and attributes is incomplete.

# Revenge of the Great Principles

- “Those great principles of sufficient reason and of the identity of indiscernibles change the state of metaphysics. That science becomes real and demonstrative by means of these principles, whereas before it did generally consist in empty words” (LIV.5, AW 299b).
- Could the universe, for example, have been created at a different time?
- Could it be moved three inches to the left?
- There would be no way to distinguish two universes that were identical in all their relations among objects, but put into a different space, or reoriented.
- “Those two states, the one such as it is now, the other supposed to be the quite contrary way, would not at all differ from one another. Their difference therefore is only to be found in our chimerical supposition of the reality of space in itself. But in truth, the one would exactly be the same thing as the other, they being absolutely indiscernible, and consequently there is no room to inquire after a reason for the preference of the one to the other” (LIII.5, AW 297b-298a; see also LIV.13, AW 300a-b).

# Leibnizian Space and Time



- Space is a set of relations among bodies.
- Time is an abstract relation among events (or perceptions).
- Those systems of relations might be thought of as abstract, but they should not be reified.
- The family tree analogy
- No really existing thing could be infinitely divisible.
  - We must take space and time to be ideal, or imaginary constructs derived from the appearances of bodies.
- Bodies, for Leibniz, are just appearances.
  - Space and time turn out to be abstractions on what is already only a mere appearance.
  - The only reality is monadic.
  - Monads have temporal properties, but not spatial properties, except in a thin, derivational sense.

# End Continental Rationalism

- Return to our senses