L2: THEORIES OF TIME

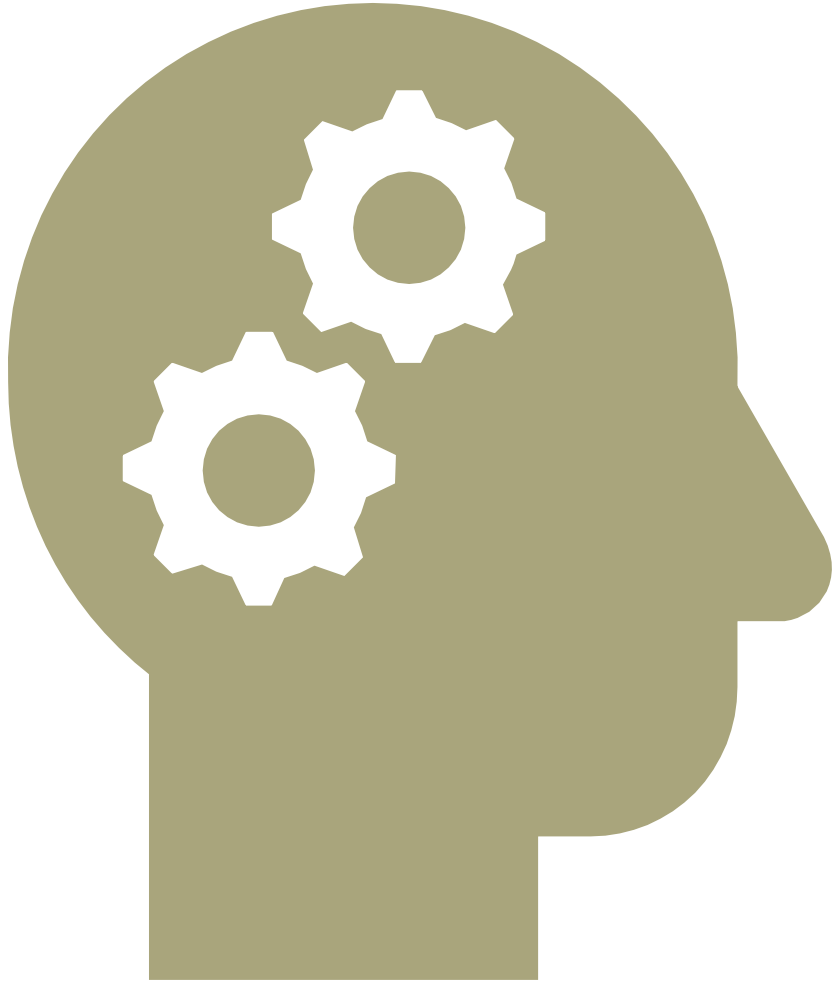
INTUITIONS AND THEORY

INTUITIONS AND THEORY

In the previous lecture, we formulated a set of intuitions about time.

- In order to analyze these intuitions, it is helpful to formulate a set of theories
- We'll use these theories to critically evaluate our intuitions
- Some theories will better correspond with our starting intuitions than others

WHAT IS A THEORY OF TIME?



WHAT IS A THEORY OF TIME?

A **theory of time** consists of three components:

(1) a **theory of temporal ontology**

(2) whether the theory is an A-theory or B-theory

(3) a theory of temporal passage

WHAT IS A THEORY OF TIME?

A **theory of time** consists of three components:

(1) a **theory of temporal ontology:** theory about how an event's position in time determines whether that event is real (e.g. are past events real)

(2) **A-theory or B-theory:** whether past, present, and future are absolutely real, or whether temporal reality consists of nothing more than relations between events

(3) a **theory of temporal passage:** theory about whether what is real changes relative to time.

TEMPORAL ONTOLOGY

TEMPORAL ONTOLOGY

Ontology refers to a branch of metaphysics that deals with the types of things that exist (that is, are real).

- Do spirits or souls or immaterial things exist?
- Do physical things exist? If so, what kind?
  Just microphysical particles or also complex entities?
- Does God exist?
- Do parts of things exist?
- Do vague objects exist?
- Do numbers or fictional objects exist?

TEMPORAL ONTOLOGY

Everyone has an ontology (even if you haven't thought about it very explicitly). It deals with the *types of things* you take to be real.

- The *chemist* may take molecules to be real, but not societies or full-blown human beings (societies and humans are just molecules!).
- The *physicist* may take microphysical particles to be real (those molecules are just particles)
- A *child* may take unicorns to be real
- A *mathematician* may take abstract objects to be real (e.g. numbers).

TEMPORAL ONTOLOGY

Temporal ontology refers to the types of events that exist *in time* (the times that exist) and the structure of those events in time (their relation to each other)

- Typically, we talk about **events** existing in time, but we could also talk about *objects* or *states of affairs* in time.

TEMPORAL ONTOLOGY

Defining a **time** is itself a philosophical question.

- Sometimes a **time** is defined as *a complete and consistent specification (snapshot, full description, picture, account) of a world at an instant.*
- But then we have the question of **well what is an instant?**
- We won't define time. Instead, we'll be concerned with whether an event's position in time influences whether or not that event exists.

TEMPORAL ONTOLOGY

Plural times hypothesis: there is more than one time

- There are at least two events E1 at t1 and E2 at t2 such that t1 does not equal t2.
- This hypothesis is supported by the belief that there are incompatible specifications of the world.
- **Example:** There is the specification of the duck in the air and the specification of the duck on the ground. Two different specifications and if both are real, then they must be at different times.

TEMPORAL ONTOLOGY

The structure of time

THE STRUCTURE OF TIME

To get started, let's suppose there are three events in time.

- t1: July 16, 1945 (5:29 AM) - Testing of a nuclear weapon at the Trinity Site, New Mexico
- t2: July 21, 1969 (2:56 UTC) - Neil Armstrong steps foot on the moon
- t3: Sept 5, 2101 (8:56 UTC) - Alien life arrives on earth

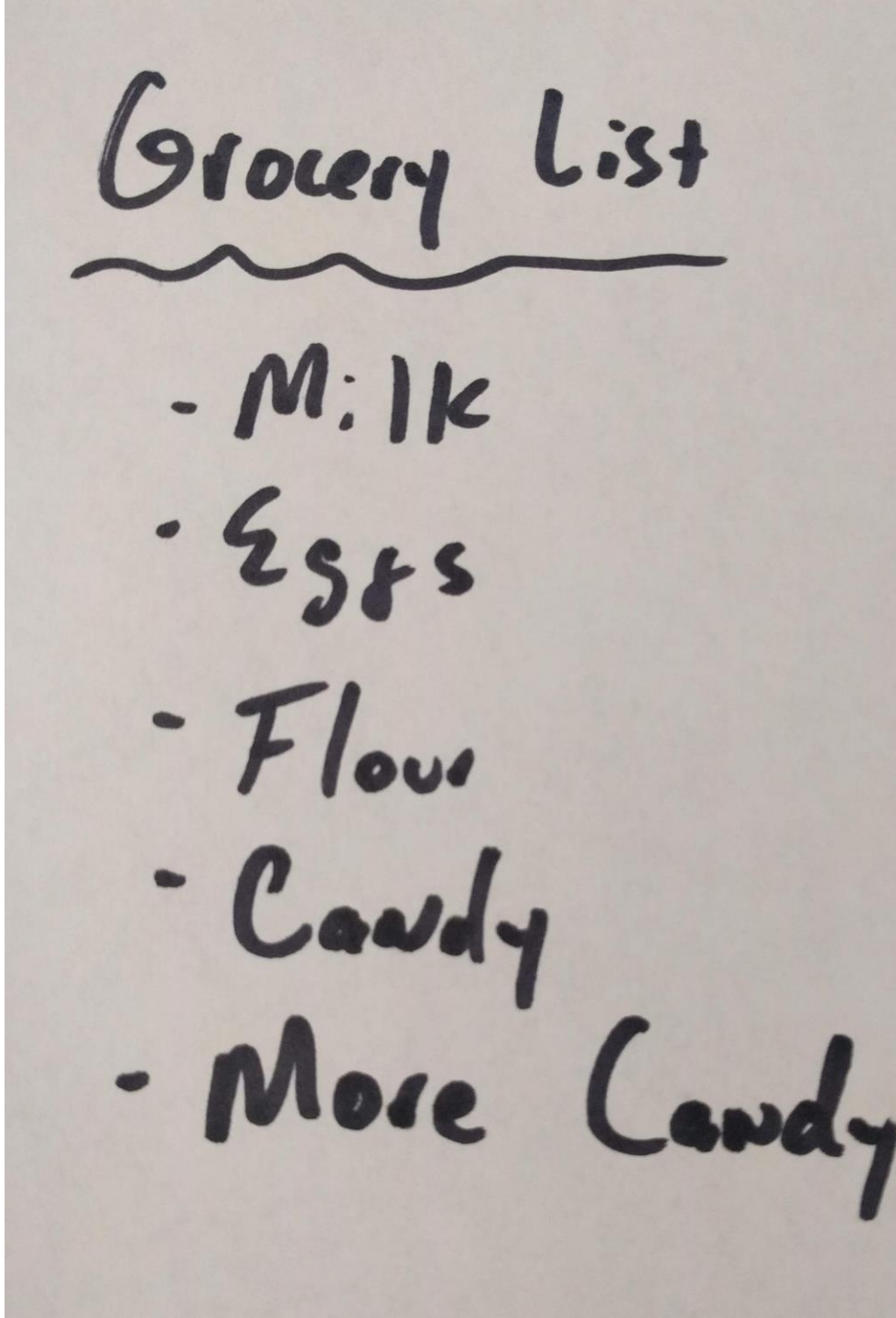
A-SERIES

But t1, t2, t3 are just isolated events in time.

- What is their relation to each other?
- What is the structure or organization to these times as a whole?
- What is their relation to all that exists in time?

THE STRUCTURE OF TIME

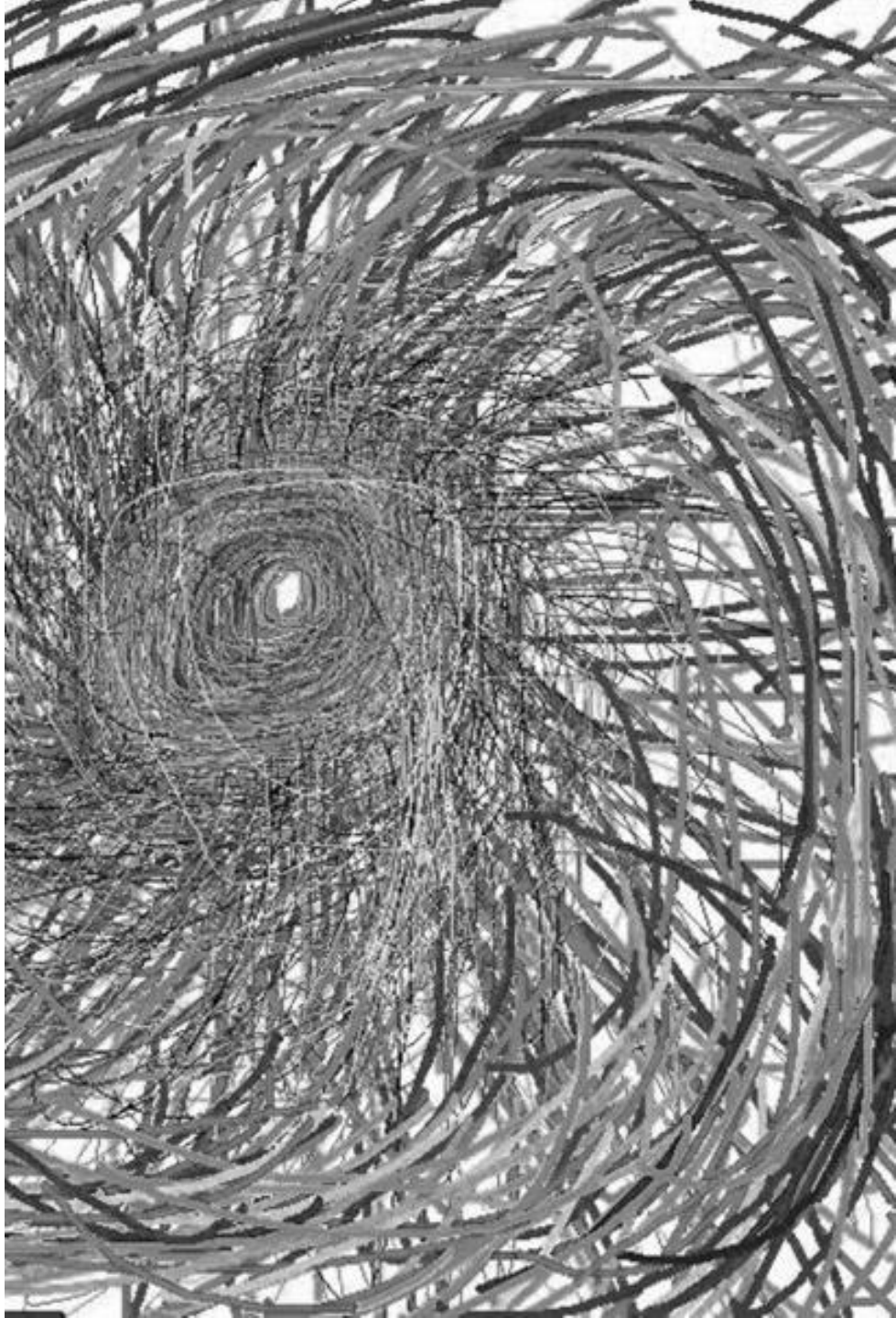
- Events t1, t2, t3 can be put into a **set:** {t1, t2, t3}
- But a set is simply an **unordered collection.** I can write the set {t2, t1, t3} and it is still the same set.
- Example: My grocery list is a set.
- The world does not simply consist of a set of events. Events in the world are **ordered.**
- They are in relation to each other
- There is an organization to events (they are in a **sequence**).



THE STRUCTURE OF TIME

Sets of events can be **ordered** in different ways.

- I can order t1, t2, and t3 from my favorite to my least favorite
- I can order t1, t2, and t3 from most to least important
- Events in the world are not ordered in this way (subjective preference or historical significance).
- **Question:** How then are events in time ordered?



THE STRUCTURE OF TIME

We have established that there are multiple times but haven't established how they are ordered. There are two ways:

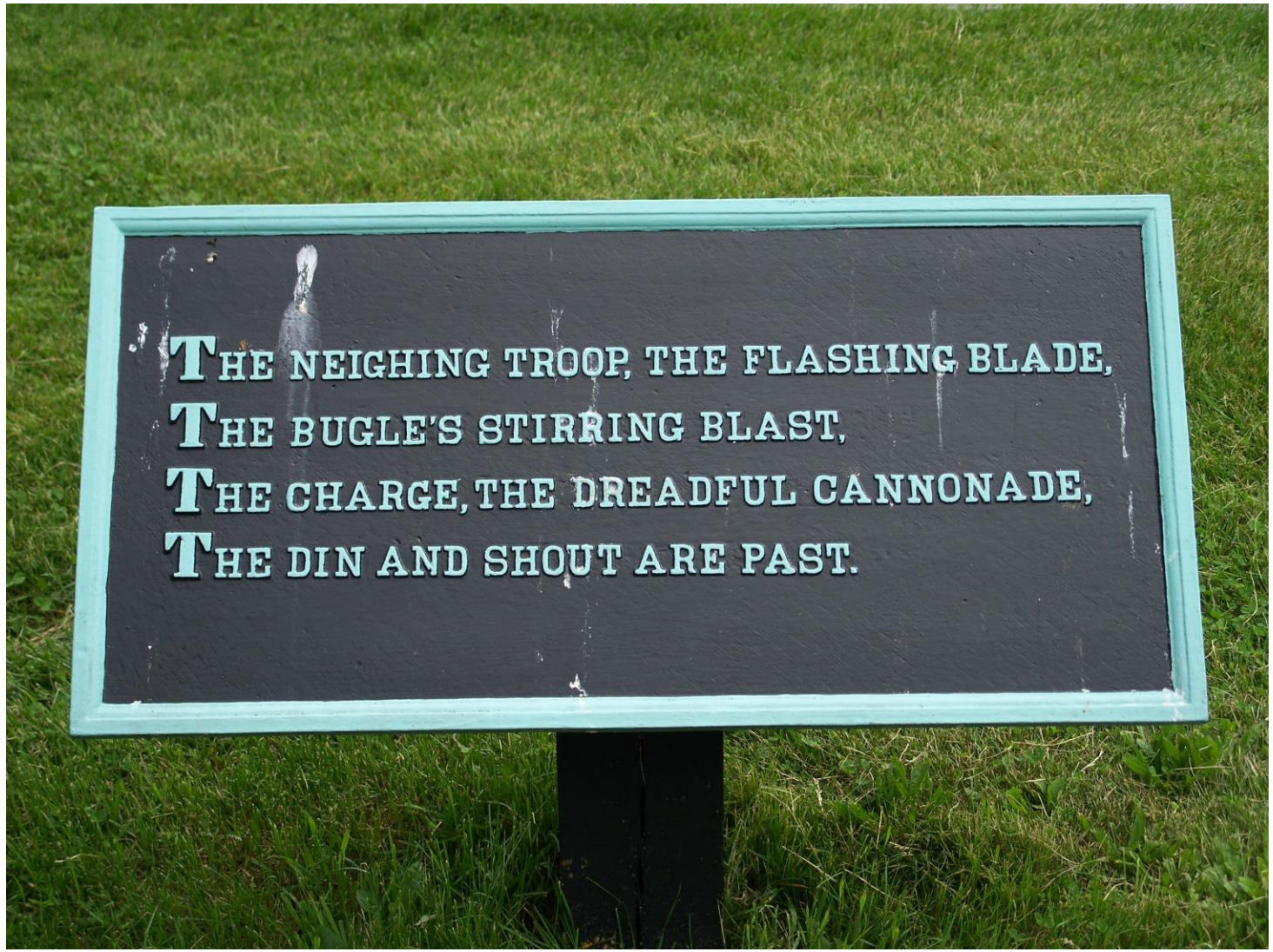
- **A-series:** Using the properties **past**, **present**, and **future**
- **B-series:** Using the relations **is earlier than, is simultaneous with, is later than**

TEMPORAL ONTOLOGY

The structure of time: A-series and B-series

A-SERIES

- The first way to organize times / events is through the **A-series.**
- To define the A-series, we need to introduce some terminology



A-SERIES

- A-term: "past", "present", "future"
- Allows us to put t1, t2, t3 in a temporal sequence

A-SERIES

- A-terms always involve **an implicit reference to the present.**
- Example: Something is past relative to what time is present
- We don't need to simply use "is past", "is present", and "is future".
- We could specify **how far away** an event is from the present

A-SERIES

- A-terms seem to express **A-properties**
- *Language* involves **terms** but *things/events* have **properties**
- Just as a bike has the property of *being red*, events have the property of *being past*, *being present*, or *being future*

A-SERIES

- Propositions that contain A-terms are A-sentences (or A-propositions)
- Note 1: The truth or falsity of these sentences appear to depend upon events really having A-properties
- Note 2: The truth or falsity of these sentences appear to change

A-SERIES

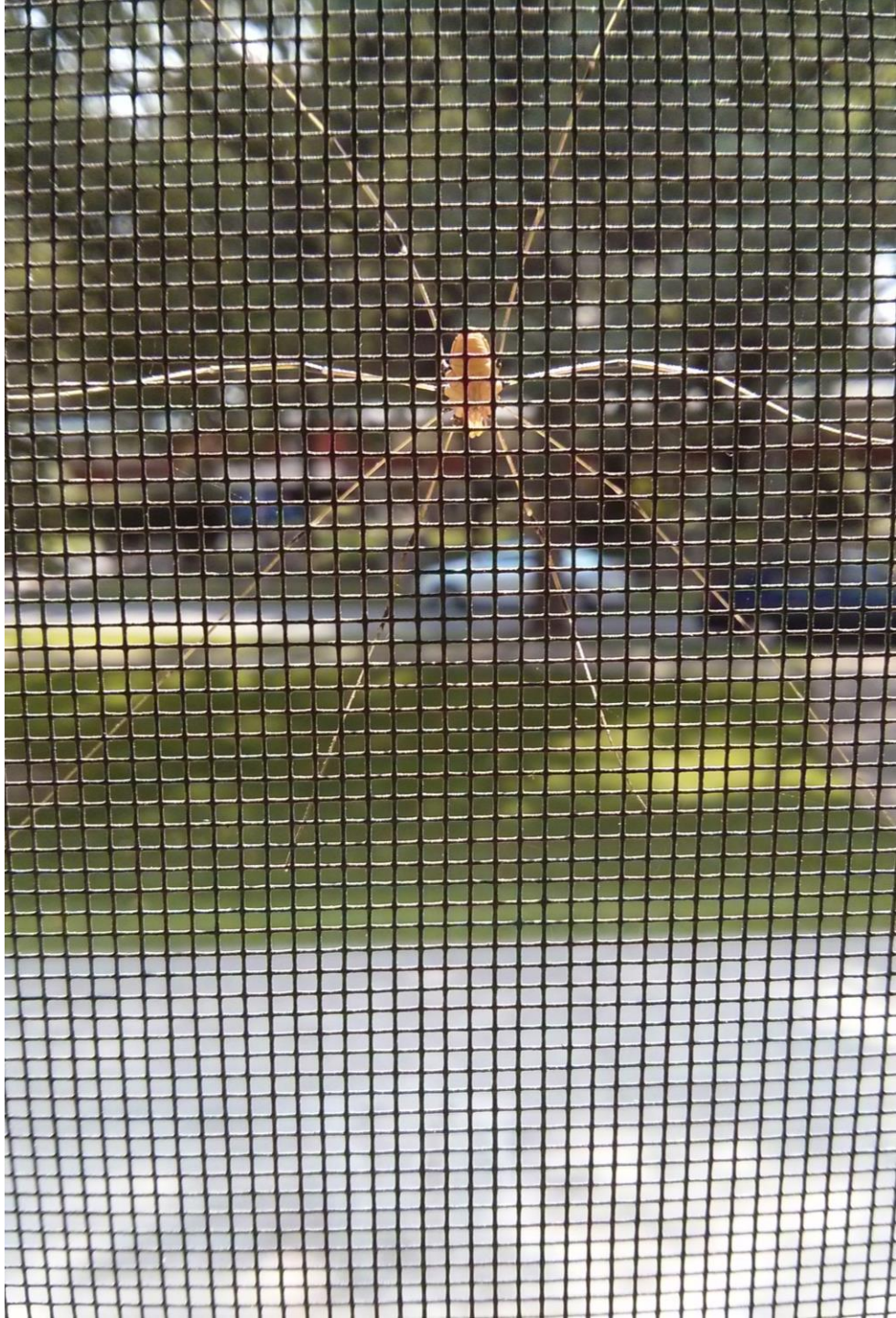
- The **A-series** is an ordering of times (events) that orders times using A-terms / A-properties

Note: A-terms might be said to refer to events themselves. In this case, they wouldn't be referring to A-properties but just an event that is present.

- Example: "is present" refers to the property of being present (like the property of being red)
- Example: "is present" refers to a specific event, the present moment.

B-SERIES

- The second way to organize times / events is through the **B-series.**
- To define the B-series, we need to introduce some terminology



B-SERIES

- **B-term:** "earlier than", "simultaneous with", "later than"
- Allows us to put t1, t2, t3 in a temporal sequence

B-SERIES

- B-terms **do not** involve **an implicit reference to the present**
- Example: T1 being earlier than T2 does not tell us whether T1 or T2 is present (or how away from the present T1 or T2 are)
- In addition, if we had more events, we could always specify how much earlier or later an event is from another event (e.g. 23 years later).

B-SERIES

- B-terms express **B-properties (B-relations)**
- The relation *loving* is a two-place relation. It relates a LOVER to a BELOVED.
- B-terms thus express B-relations

B-SERIES

- Propositions that contain only B-terms are **B-sentences** (or B-propositions)
- Note 1: The truth or falsity of these sentences appear to depend upon events really having B-relations
- Note 2: The truth or falsity of these sentences **does not** change. T1 is always earlier than T2.

B-SERIES

- The **B-series** is an ordering of times (events) that orders times using only B-terms / B-relations

A-SERIES AND B-SERIES

There are thus two ways to order times / events:

1. A-series: using terms like past, present, future
2. B-series: using relations like before, earlier, later

A-THEORY AND B-THEORY

You can build two different **theories** out of the A-series and B-series.

- The **A-theory** asserts that events are organized in time by **A-properties and B-relations**. This means the world really has a present, past, and future (time is organized around a present moment) and events can be said to be earlier than or later than other events.
- The **B-theory** asserts that events are only organized in time by **B-relations**. This means that there is no such thing as an objective present, objective past, or objective future. Instead, there are events that are *earlier than* or *later than* or *simultaneous with* others.

QUESTION

We have outlined two ways to structure time. One way uses the A-series, the other the B-series. From this, we can build two theories concerning the structure of time: the A-theory and B-theory

1. In your own words, describe the A-theory and B-theory. In explaining each, be sure to explain concepts that are foundational to the theory: A-terms, B-terms, A-series, and B-series.
2. Which theory is more intuitive? Explain your reasoning.
3. Which theory (if any) is more rationally persuasive? Explain your reasoning.

TEMPORAL ONTOLOGY

Models of temporal ontology

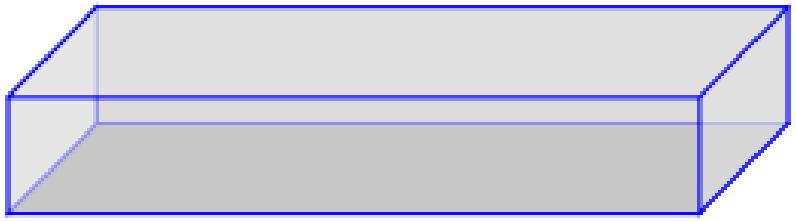
MODELS OF TEMPORAL ONTOLOGY

- We have introduced **two theories** (A-theory and B-theory) about the structure time
- Neither theory tells us at least explicitly about **what times exist** (which events in time are real)
- A **model of temporal ontology** aims to provide an account of what times exist
- A **theory of temporal ontology** will thus (1) give an overall account of the structure of time and (2) tell us what events exist in time.

MODELS OF TEMPORAL ONTOLOGY

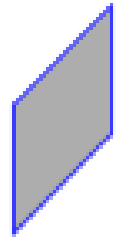
Let's begin with a three-dimensional block

Let's suppose the three dimensions (x, y, z) correspond to the three dimensions in space.

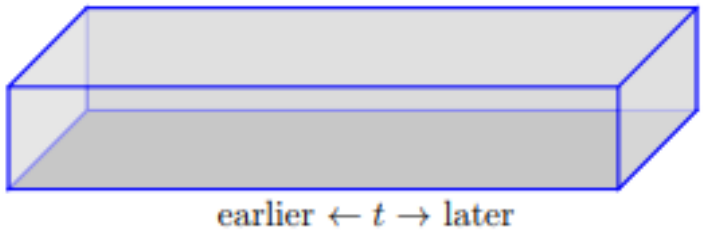


MODELS OF TEMPORAL ONTOLOGY

- Next, let's flatten this 3D block into a **2D representation.**
- Example: how we represent Earth on a 2D map

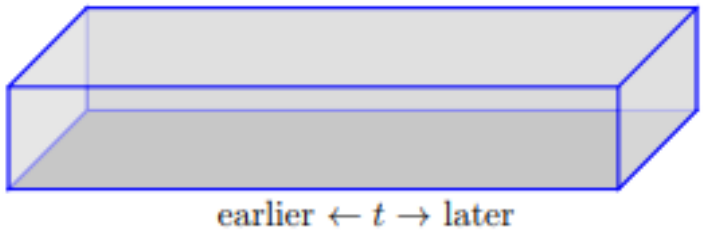


MODELS OF TEMPORAL ONTOLOGY



- Now let's add the **dimension of time** to this model
- Any point on the model is thus a position in space and time (spacetime)
- Let's also suppose that events are structured using B-relations
- Points to the left of the block are **earlier** than points to the right of the block.

MODELS OF TEMPORAL ONTOLOGY



- Single points on the block will give us specific *events* in spacetime (e.g. you eating a sandwich at 11:42PM EST)
- A 90 degree slice will give us all of the events at a specific time
- Non-90 degree slices will give us a set of spacetime events (but there times will differ)

TEMPORAL ONTOLOGY

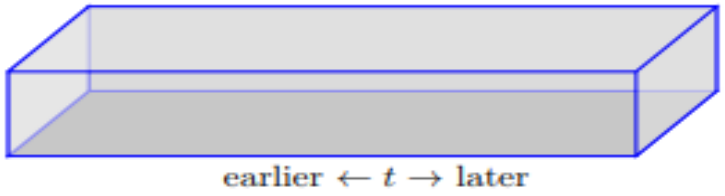
Theories of temporal ontology

A THEORY OF TEMPORAL ONTOLOGY

We can now define a theory of temporal ontology more exactly

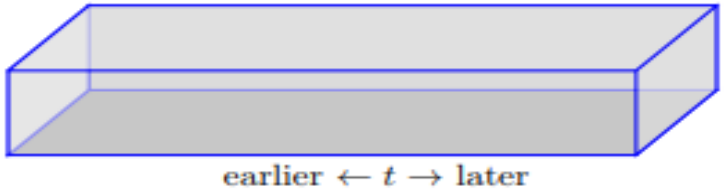
A **theory of temporal ontology** states (1) whether and how an event's existence (reality) depends upon its position in time (what times/events exist in time) and (2) the structure of time (the temporal sequence of times – A-theory or B-theory)

THEORIES OF TEMPORAL ONTOLOGY



Eternalist temporal ontology is the theory of temporal ontology that states that (1) an event's reality does **not** depend upon its position in time and (2) the **B-theory** is true (time is structured only by B-relations)

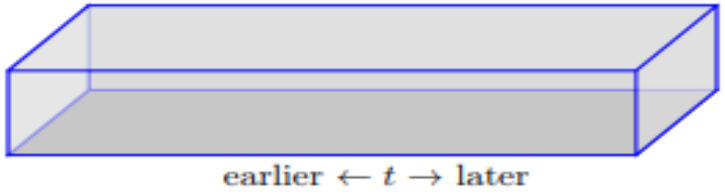
THEORIES OF TEMPORAL ONTOLOGY



Eternalist temporal ontology

- This view is sometimes call **permanentism** (every event in time is permanent)
- An event's location (past, present, future) does not determine whether that event is real.
- t1 might be earlier than t2, but they both are real.
- All events in time *exist simpliciter*

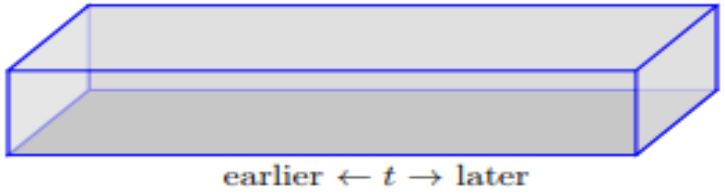
THEORIES OF TEMPORAL ONTOLOGY



Eternalist temporal ontology

- accepts the B-series (only earlier, later relations)
- an event's reality does not depend upon there being an objective present moment

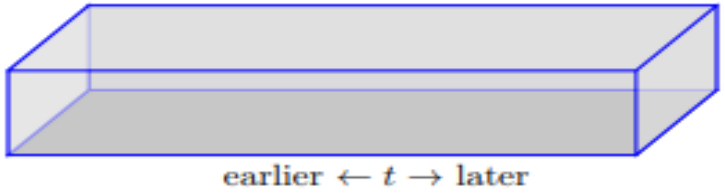
THEORIES OF TEMPORAL ONTOLOGY



Eternalist temporal ontology

- Does not accept the A-theory
- There is no absolute (non-relativistic) notion of the present moment
- Every moment in time is real but there is no moment in time that is present

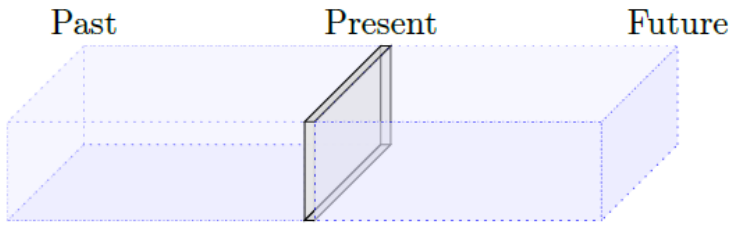
THEORIES OF TEMPORAL ONTOLOGY



Eternalist temporal ontology (Example)

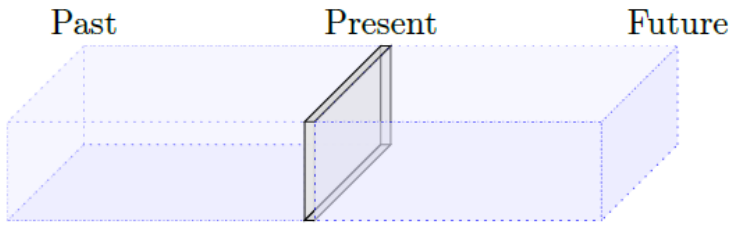
- You here looking at me is real (it is an event in time)
- George Washington doing X (an event earlier than you here looking at me) is real
- Future events are also real

THEORIES OF TEMPORAL ONTOLOGY



Presentist temporal ontology is the theory of temporal ontology that states that (1) an event's reality **does** depend upon its position in time for **only present events are real** and (2) the A-theory is true (time is structured by A-properties and B-relations)

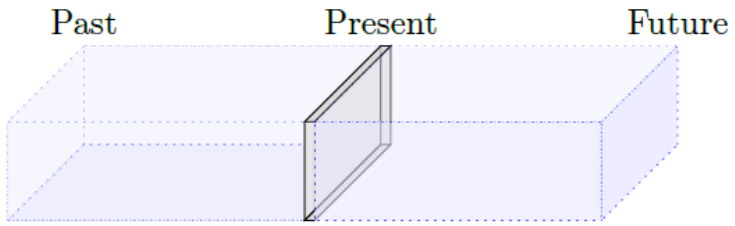
THEORIES OF TEMPORAL ONTOLOGY



Presentist temporal ontology

- Reality is exhausted by what exists in the present
- Only present events are objectively real
- Reality is completely found in a 90° slice of the model

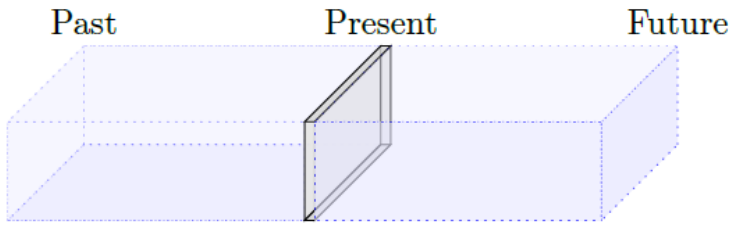
THEORIES OF TEMPORAL ONTOLOGY



Presentist temporal ontology

- Accepts the A-theory in a sense
- While there is no objective reality to past and future events, presentism orders the only time that exists using A-terms
- It is true or false to say "e1 is present"
- Accepts the objective reality of the A-property of *being present*

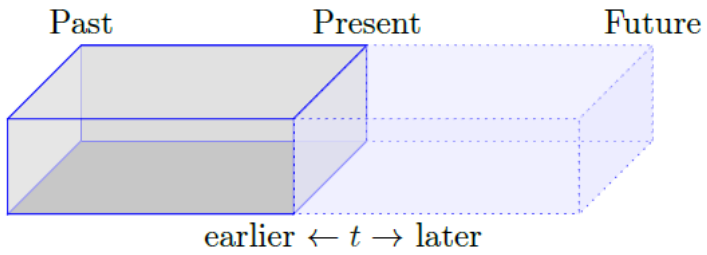
THEORIES OF TEMPORAL ONTOLOGY



Presentist temporal ontology (Example)

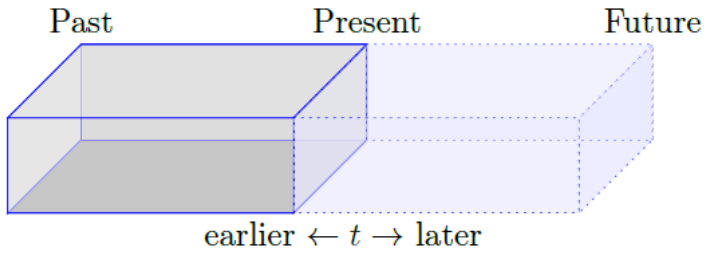
- You here now looking at me is real.
- George Washington doing something is not real
- Future events are not real.

THEORIES OF TEMPORAL ONTOLOGY



Past-presentist theory of temporal ontology is the theory of temporal ontology that asserts (1) an event's existence depends upon its position in time for only past and present events exist and (2) the A-theory is true (time is structured by A-properties and B-relations)

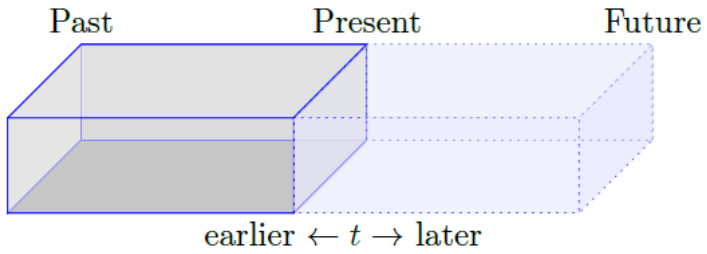
THEORIES OF TEMPORAL ONTOLOGY



Past-presentist temporal ontology

- Reality is exhausted by what exists in the past and the present
- Past and present events are objectively real
- Reality is completely found in a 90° slice of the model and everything earlier

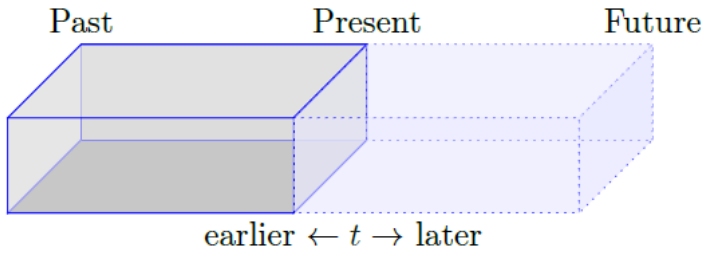
THEORIES OF TEMPORAL ONTOLOGY



Past-presentist temporal ontology

- Accepts the A-theory in a sense
- While there is no objective reality to future events, but past-presentists order the time that is real using A-terms ("is past", "is present")
- Accepts the objective reality of the A-property of *being present* and *being past*.

THEORIES OF TEMPORAL ONTOLOGY



Past-presentist temporal ontology (Example)

- You here now looking at me is real
- George Washington doing X in the past is also real
- Future events are not real (at least not yet)

QUESTION

We have outlined three theories of temporal ontology.

1. In a small group, take a moment to briefly articulate each theory in your own words.
2. Which theory do you find the most persuasive and why?
3. Which theory do you find the most puzzling and why?

QUESTION

One fundmantal issue for a temporal theory of ontology is **whether an event's position in time determines whether that event is objectively real**. With respect to those theories that contend an event's temporal position does matter, we considered **presentism** and **past-presentism.** However, other theories are possible (e.g. futurism – only future events are objectively real)

1. Are there any theoreis of temporal ontology not considered here that you think might be reasonable?
2. Try to pick a theory of temporal ontology not considered here. Articulate that theory (remember you'll need to address both parts of a theory of temporal ontology).

THEORIES OF TIME

Theories of temporal passage

THEORIES OF TIME

Recall that a **theory of time** provides a **theory of temporal ontology** along with a **theory of temporal passage**.

- We have introduced three theories of temporal ontology: eternalist, presentist, past-presentist
- To formulate a theory of time, we now need to introduce a theory of temporal passage.

THEORIES OF TEMPORAL PASSAGE

THEORIES OF TEMPORAL PASSAGE

- A theory of temporal passage is a theory about whether there is change in the world
- There are two types of change:

1. **Property change:** a change to the properties objects / events have in the world
2. **Ontological change:** a change to what exists in the world

THEORIES OF TEMPORAL PASSAGE

There are two main theories of temporal passage:

1. **Dynamic** theories of temporal passage
2. **Static** theories of temporal passage

THEORIES OF TEMPORAL PASSAGE

A **dynamic theory of temporal passage** asserts

1. **Temporal passage involves real change:** either (1) in the acquistion / loss of the property of being present (property change) or (2) in a change as to what events / objects are real.
2. **Change is due to the objective reality of a moving present:** either (1) events take on the property of being present or (2) new events become real because they become present.

THEORIES OF TEMPORAL PASSAGE

We can thus say there are two dynamic theories or temporal passage:

1. **Property change dynamic theory:** temporal passage involves real change to the properties of the world in that which moment has the property of being present changes with the moving present moment
2. **Ontological change dynamic theory:** temporal passage involves real change to what exists in the world in that what exists changes with the moving present moment.

Example: t1 is present because t1 has the **property** of being present
Example: t1 is present because in being present, it determines what exists.

THEORIES OF TEMPORAL PASSAGE

- One key idea is that dynamic theories say temporal passage (the passing of time) is a **feature of reality.**
- The passage of time is a feature of the world
- Time really does pass!

THEORIES OF TEMPORAL PASSAGE

A **static theory of temporal passage** asserts

1. Temporal passage does not involve any real change
2. There is no moving present moment

THEORIES OF TEMPORAL PASSAGE

- One key idea is that the static theory says temporal passage (the passing of time) is a **perspectival fact**.
- The passage of time is not a feature of the world. It is a feature of how we see the world.
- Time does not really pass.

THEORIES OF TIME

THEORIES OF TIME

Theory of time = theory of temporal ontology + theory of temporal passage

Theories of temporal ontology

- Eternalist
- Presentist
- Past-presentist

Theories of temporal passage

- Property change dynamic theory of temporal passage
- Ontological change dynamic theory of temporal passage
- Static theory of temporal passage

THEORIES OF TEMPORAL PASSAGE

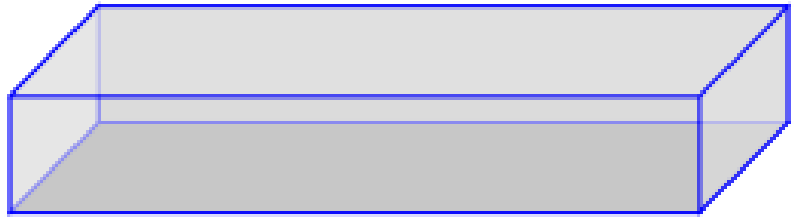
- There are several *possible* theories of time
- We will only consider **four** theories

1. Eternalism
2. Presentism
3. Moving spotlight theory
4. Growing block theory

THEORIES OF TEMPORAL PASSAGE

Eternalism (or the Block Theory) is the theory of time that consists of (1) the eternalist theory of temporal ontology and (2) the static theory of temporal passage.

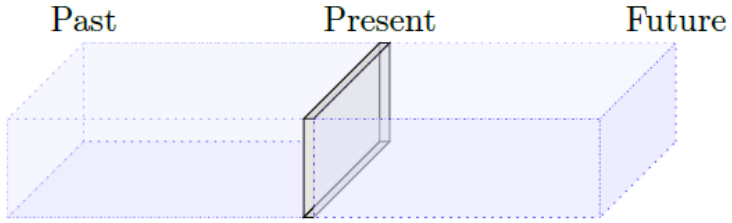
1. An event's position in time does not determine whether it exists
2. Time is structured by the B-theory
3. There is no movement or change to what exists (temporal passage is a perspectival fact)



THEORIES OF TEMPORAL PASSAGE

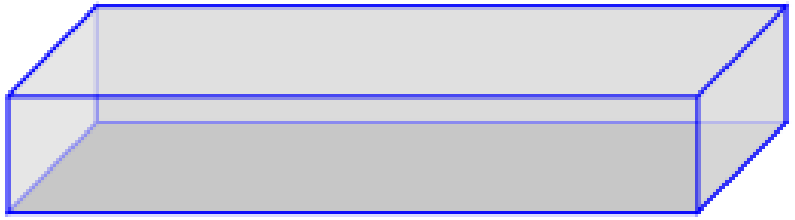
Presentism is the theory of time that consists of (1) the presentist theory of temporal ontology and (2) the ontology change dynamic theory of temporal passage.

1. An event's position in time does determine whether it exists for only present events exist
2. Time is structured by the A-theory
3. Change occurs: what events exist is determined by the moving present



THEORIES OF TEMPORAL PASSAGE

Moving spotlight theory is the theory of time that consists of (1) the eternalist theory of temporal ontology (although it accepts the A-theory) and (2) the property change dynamic theory of temporal passage.

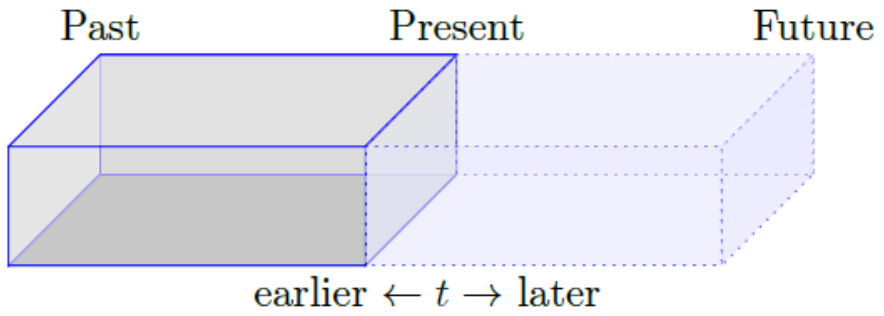


1. An event's position in time does not determine whether it exists
2. Time is structured by the A-theory
3. There is change since which event has the property of *being present* changes

THEORIES OF TEMPORAL PASSAGE

Growing block theory is the theory of time that consists of (1) the past-presentist theory of temporal ontology and (2) the ontology change dynamic theory of temporal passage.

1. An event's position in time does determine whether it exists
2. Time is structured by the A-theory
3. Change occurs: what exists is growing as new events are added to past events



QUESTION

1. Form a small group. In the group, collectively pick one of the four theories of time. Articulate this theory as best you can *in your own words* (try to be as detailed as possible)
2. Next, on the board, present your theory of time the best way you can.
3. Write down any key claims or key ideas.
4. Be sure to include at least one picture, drawing, illustration to help clarify your theory.

QUESTION

Other theories of time: A theory of time consists of a theory of temporal ontology and a theory of temporal passage. Since there are three theories of temporal ontology and three theories of temporal passage, there are other possible theories of time.

1. In a small group, try to devise another theory of time (it must be a combination of one of the three theories of temporal ontology along with one of the three theories of temporal passage)
2. Articulate this theory the best you can (the theory itself doesn't have to be plausible)

REVIEW QUESTIONS

1. What is ontology?
2. What is the A-series and A-theory?
3. What is the B-series and B-theory?
4. A theory of time consists of two parts. What are those two parts?
5. What are the three theories of temporal ontology?
6. A theory of temporal passage consists of two parts, what are those two parts?
7. What are the three theories of temporal passage?
8. What are the four theories of time?

SOURCES FOR ILLUSTRATIONS

1. Picture of Trinity
   Test: https://commons.wikimedia.org/wiki/File:Trinity_Detonation_T%26B.jpg
2. Armstrong on
   Moon: https://en.wikipedia.org/wiki/Neil_Armstrong#/media/File:As11-40-5886.jpg
3. UFO: https://en.wikipedia.org/wiki/Unidentified_flying_object#/media/File:PurportedUFO2.jpg