

A grayscale portrait of Immanuel Kant, a German philosopher. His face is obscured by a solid black rectangle. The text of the slide is overlaid on this image.

Lecture 5

Kant, Hands, Space

GEB 3301 Space, Time, and Einstein for Everyone

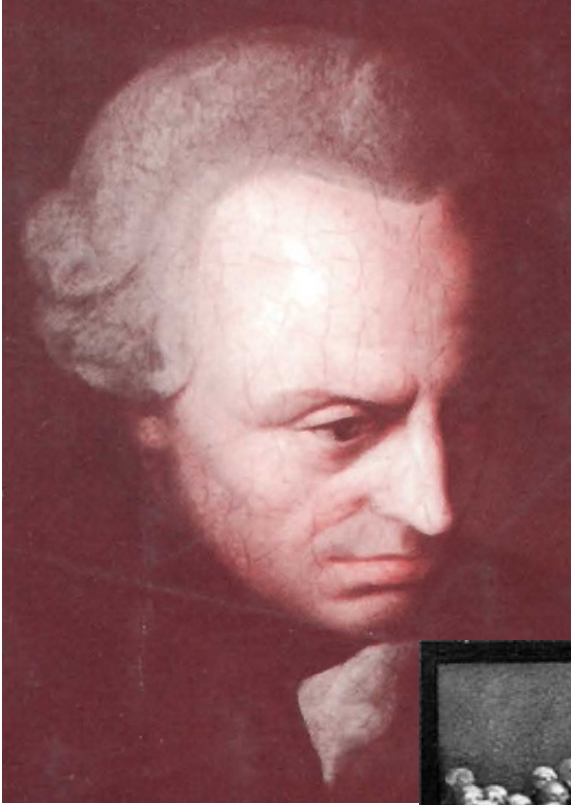
Lara Xiaoqian Hu

KANT TOUCH THIS

Review of last week

- **What do you guys remember?**
- Newton's system and scholium
- Newton's view on space and time
- Leibniz's Metaphysical System (Monads & metaphysical principles)
- Leibniz's view on space and time

Immanuel Kant (1724-1804)



Little Kant
Pontificating to
the Throng

Immanuel Kant

- Born: April 22, 1724, in Königsberg (part of Russia today, capital of East Prussia)
- Königsberg: Major commercial center, military port, and cosmopolitan university town
- Family background: Artisan family of modest means
- Father: Master harness maker
- Mother: Daughter of a harness maker, relatively well-educated for her social class.

Europe shortly before 1789

SCALE IN MILES
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- Boundary of the Holy Roman Empire
- Hapsburg Lands
- Hohenzollern Lands
- Wettin Lands
- Wittelsbach Lands
- Oldenburg Lands
- Ecclesiastical Lands



Immanuel Kant

- Attended University of Königsberg (Albertina)
- Early interest: Classics, later superseded by philosophy
- Philosophy studies included: Mathematics, physics, logic, metaphysics, ethics, natural law
- Worked as a private tutor for six years after college
- Financial situation prevented immediate pursuit of academic career

Immanuel Kant

- Returned to Königsberg in 1754 and started teaching at the Albertina in 1755
- Taught philosophy for four decades until retirement in 1796 at age 72
- Unsalaries lecturer, relied on student payments for income
- Lectured extensively, averaging 20 hours per week
- Covered subjects such as logic, metaphysics, ethics, mathematics, physics, and physical geography

Some of Kant's Major Works

(1755) *Universal Natural History of the Heavens*

(1763) *On the Only Possible Argument for the Existence of God*

(1770) *Dissertation On the Form and Principles of the Sensible and the Intelligible Worlds*

(1781 & 1787) *Critique of Pure Reason* (in 1781 Kant is 57 years old)

(1785) *Groundwork for the Metaphysics of Morals*

(1786) *Metaphysics of Natural Science* (philosophical foundations for Newtonian physics)

(1788) *Critique of Practical Reason*

(1790) *Critique of Judgment* (in two parts, Critique of Aesthetic Judgment (beautiful and sublime) and Critique of Teleological Judgment (organisms and purposes in nature))

(1793) *Religion Within the Boundaries of Reason Alone*

(1797) *Metaphysics of Morals* in two parts, the *Doctrine of Right* (law) and the *Doctrine of Virtue* (personal conduct and character)

Discussion on Kant

- https://www.bilibili.com/video/BV1FZ4y1R7q2/?spm_id_from=333.337.search-card.all.click&vd_source=148a19de6576e81ff1e593c3f66f314e

Philosophical questions about space and time

- Kant wrote in his *Inaugural Dissertation* of 1770:
- “Space is not something objective and real, nor a substance, nor an accident, nor a relation; instead, it is subjective and ideal, and originates from the mind’s nature in accord with a stable law as a scheme, as it were, for coordinating everything sensed externally” (Ak 2: 403).

Topic 1

- **Question 1: Is space “real,” or is it “ideal” in some sense? Is it a substance in its own right, a property of some substance, or perhaps neither?**

Topic 2

- A second topic arises **if we consider the ontology of space and time independently from the substance-property metaphysical framework, e.g. by considering the relationship of space and time to physical objects.**
- Absolutism (now sometimes called “substantivalism”), the view that space and time exist independently of all possible objects and object relations, or perhaps the view that space-time points exist.
- Relationalism, the view that space and time depend for their existence on possible objects and relations, or perhaps the view that space-time points do not exist.

Topic 3

- **Question 3: What is the origin of our representation of space and of time?**

Topic 4

- The fourth topic follows on the heels of the third: **what is the content of our idea or representation of space and time?**

Topic 5

- Question 5: **What is the relationship between space and time, on the one hand, and the human mind, on the other?**
- If we think of the mind as representing space and time in a certain way, then perhaps this is part of our understanding of the mind's relationship with space and time themselves.

Topic 5

- But within the context of Kant's work, there is, at least *prima facie* (on the first impression), another issue lurking here—**are space and time somehow dependent upon the mind for their existence?** It may be that some kind of dependence is suggested by the origin—or by the content—of our representation of space and time (or perhaps by these two jointly).
- But Kant also seems to think that a view recognizing the dependence of space and time on the mind might offer advantages in addressing the ontological problems mentioned above.

The background to Kant's views in the *Critique*

- Critique of rationalism and empiricism
- Formulated a third alternative
- Rationalism: True knowledge from pure reason
- Empiricism: Knowledge based on direct experience
- Rationalism's weakness: Knowledge requires experience
- Empiricism's weakness: Narrow understanding of knowledge
- Kant's belief: Empirical knowledge requires certain first principles, including a conception of space

The background to Kant's views in the *Critique*

- Two components of every experience: sensations and organizing framework
- Sensations: Perceptions of things
- Organizing framework: Spatial organization
- Spatial organization: Things located in space, next to each other, above each other, etc.
- Space as the framework for all experiences of the physical world

The background to Kant's views in the *Critique*

- From this observation, Kant draws two conclusions:
- First, the framework is required for us to have experiences, and so it cannot come from experience but is provided, in advance, by us.
- Second, since the framework is provided prior to our experiences, our experiences will always be spatial and we can be certain in our knowledge of space. Thus we can know that every experience we will have will involve objects in Euclidean space.

The Distinction between Pure and Empirical Knowledge

- To clarify his philosophy of space, Kant emphasized two distinctions. First, he distinguishes two kinds of knowledge: **the *a posteriori* (empirical knowledge) and the *a priori* (pure knowledge)**.
- The first kind of knowledge is empirical and hence obtained from experience (i.e., newspapers contain news).
- Such knowledge can be gathered firsthand, through everyday personal experience or scientific inquiry, or secondhand from books or word-of-mouth, for instance. It includes both specific knowledge—about today's weather perhaps—and general laws—about economics, for example.

The Distinction between Pure and Empirical Knowledge

- All other knowledge is *a priori*, and **does not rely on experience at all for its justification**.
- Some examples seem uncontroversial (though some philosophers question whether any knowledge is independent of experience): for instance, $2 + 2 = 4$.
- Kant argues that we know mathematical propositions to be *a priori*, because they are necessarily and universally true; and it does seem right that such propositions don't depend for their justification on the fact that we tend to get four items whenever we add two and two of them.

The Distinction between Pure and Empirical Knowledge

- However, the history of ideas is littered with discarded beliefs that at one time were taken to be *a priori*, such as Descartes's mechanics, and also in particular many ideas concerning morality.
- Kant will argue that our knowledge of space—that is, that it is correctly described by Euclidean geometry—is *a priori*.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Analytic Statements:
 - Truth determined by the meaning of the terms involved
 - Self-evident and independent of experience
 - *A priori* knowledge
- **Please come up with an analytic statement!**
- Examples: "All bachelors are unmarried" or "A triangle has three sides."

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Synthetic Statements:
 - Truth determined by empirical evidence or experience
 - Not self-evident and requires verification
 - *A posteriori* knowledge
- **Please come up with a synthetic statement!**
- Examples: "The cat is on the mat" or "Water boils at 100 degrees Celsius."

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Analytic statements are those such as “newspapers contain news” that are true in virtue of definitions alone.
- Kant takes it that statements are in subject-predicate form, so that some property (named by the predicate) is ascribed to something (the subject).
- Then a statement is analytic just in case the predicate is part of the definition of the subject; “the predicate B belongs to the subject A, as something which is (covertly) contained in this concept A” (*Critique* this vol., p. 214).

The Distinction between Analytic and Synthetic Statements (or Judgments)

- For instance, a newspaper is defined to be “A publication . . . containing current news, editorials, feature articles, and usually advertising” (The American Heritage Dictionary), a definition which includes “containing news,” revealing that it is analytic that papers contain news.
- An analytic statement, then, does not tell you anything new or informative about its subject: it only makes explicit a part of the definition, which you know beforehand if you know what the word means.
- Kant thus calls analytic statements “explicative,” since they involve making a definition clear, or explicating the meaning of a word.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Analyticity also explains why “newspapers contain news” is *a priori*: “in framing the judgment, I must not go outside my concept, there is no need to appeal to the testimony of experience in its support” *Critique*, this vol., p. 215).
- If someone asks for the justification for believing that newspapers contain news, the appropriate response is not to point to newspapers that we have read and explain that time and again they present articles on the current state of affairs, but to explain what the word “newspaper” means.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Analyticity also explains why “newspapers contain news” is *a priori*: “in framing the judgment, I must not go outside my concept, there is no need to appeal to the testimony of experience in its support” *Critique*, this vol., p. 215).
- If you like, experience cannot be the justification of analytic beliefs, because no experience could undermine such beliefs: no newspaper could fail to contain news, on pain of simply not being a newspaper.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- On Kant's view, all other statements are synthetic, and involve ascribing some new, nondefinitional property to their subject: the "[predicate] B lies outside the concept A, although it does indeed stand in connection to it" (*Critique*, this vol., p. 214).
- Thus it is not part of the definition of the New York Times that it costs HKD 138 per month, and so when I tell you "the NYT costs 138 HKD per month," my statement is synthetic. You can know the meaning of "the New York Times" without knowing the digital paper's price, and indeed nothing in the phrase's definition precludes the digital paper costing any amount in principle. Since such statements go beyond an initial definition, "amplifying" it, Kant calls them *ampliative*.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- Since according to Kant all analytic statements are *a priori*, it follows on his view that all *a posteriori* (empirical) statements are synthetic.
- Whatever I learn from experience about the weather, economics, medicine, newspapers, and so on, is not definitional, but involves discovering new properties of things. Thus there is *a priori* analytic knowledge and *a posteriori* synthetic knowledge, but no statements are both *a posteriori* and analytic.

The Distinction between Analytic and Synthetic Statements (or Judgments)

- The scheme contains one further possibility: *a priori* synthetic knowledge.
- Such knowledge would be both necessary and universal—since *a priori*—and genuinely new—since synthetic. If we could obtain it then we would learn new facts that could be known with certainty, for they would not require the messy and often misleading business of empirical enquiry.
- For Kant, empirical knowledge can be left to the scientists, but the discovery of *a priori* synthetic truths requires not experiment, but reason alone.

Kant's Transcendental Aesthetic

- Two questions hang over the transcendental aesthetic (as published in the Second Edition of the CPR (pp. 172-192)):
 1. How is it that mathematics is *a priori* synthetic, i.e., consists in necessary judgments?
 2. How is it that mathematics, although abstract, applies to concrete experience?

Kant's Transcendental Aesthetic

- "Intuitions" and "Concepts" are both "Cognitions."
- For Kant the concept of intuition is extremely abstract.
- **Intuition** (*Anschauung*) is distinct from perception which presupposes concepts and intuitions. Also intuition is more abstract than **sensibility** (*Sinnlichkeit*).
- Kant, accordingly, discusses "intellectual intuition" (pp. 190-2).
- The mutual dependence of intuition and concepts is an absolutely fundamental proposition of Kant's epistemology.

Kant's Transcendental Aesthetic

- “Without sensibility no object [*Gegenstand*] would be given to us, and without understanding [*Verstand*] none would be thought. **Thoughts without content are empty, intuitions [*Anschauungen*] without concepts are blind.** It is thus just as necessary to make the mind's concepts sensible (i.e., to add an object [*Gegenstand*] to them in intuition), as it is to make its intuitions understandable (i.e., to bring them under concepts). Further, these two faculties or capacities cannot exchange their functions. The understanding is not capable of intuiting anything and the senses are not capable of thinking anything.” (A51/B75, trans.: p. 193-4)

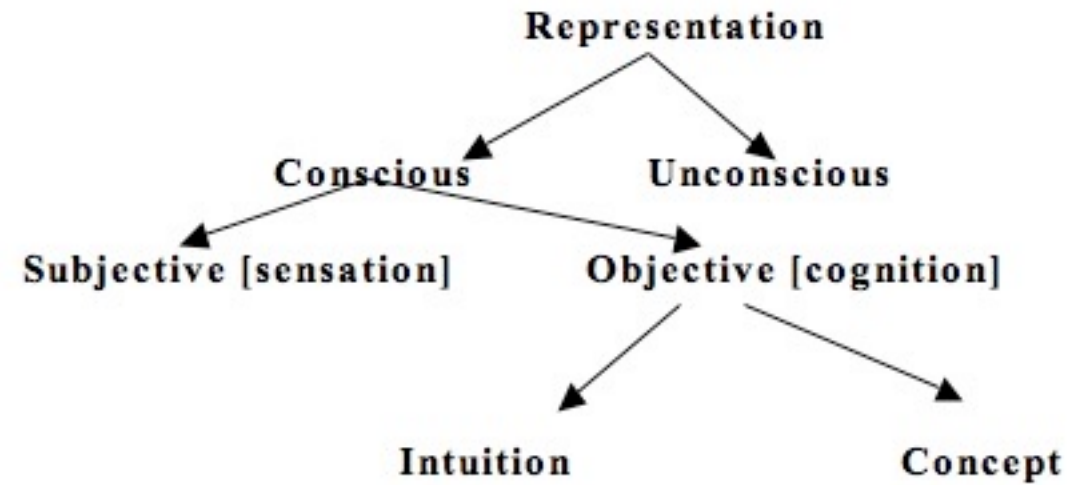
Kant's Transcendental Aesthetic

- “The effect of an object on the capacity for representation, insofar as we are affected by it, is **sensation**. That intuition which is related to the object through sensation is called **empirical**. The undetermined object of an empirical intuition is called **appearance** [*Anschaung*].
- I call that in the appearance which corresponds to sensation its **matter**, but that which allows the manifold of appearance to be ordered in certain relations I call the form of appearance. Since that within which the sensations can alone be ordered and placed in a certain **form** cannot itself be in turn sensation, the matter of all appearance is only given to us *a posteriori*, but its form must all lie ready for it in the mind *a priori*, and can therefore be considered separately from all sensation.” (p. 172)

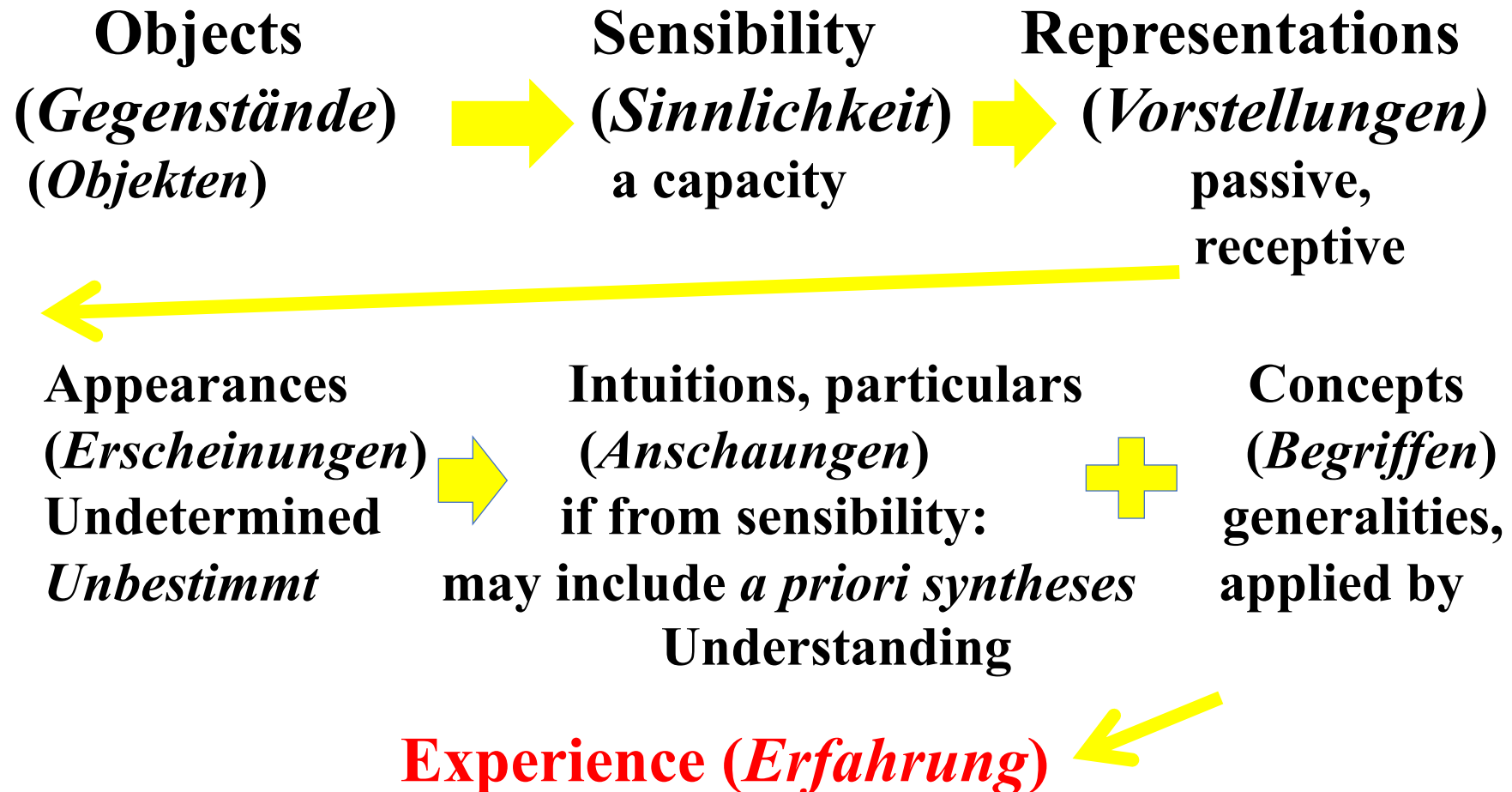
Kant's Transcendental Aesthetic

- “I call all representations **pure** (in the transcendental sense) in which nothing is to be encountered that belongs to sensation. Accordingly the pure form of sensible intuitions in general is to be encountered in the mind *a priori*, wherein all of the manifold of appearances is intuited in certain relations. This pure form of sensibility itself is also called **pure intuition**. So if I separate from the representation of a body that which the understanding thinks about it, such as substance, force, divisibility, etc., as well as that which belongs to sensation, such as impenetrability, hardness, color, etc., something from this empirical intuition is still left for me, namely extension and form. These belong to the pure intuition, which occurs *a priori*, even without an actual object of the senses or sensation, as a mere form of sensibility in the mind.” (p. 173, A21/B35)

Kant's Transcendental Aesthetic



Kant's Picture of Sense-Experience

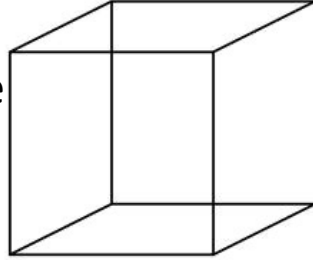


Two Worlds Seen from a Scientific Point of View

Plato

Reality Itself

- Completely Knowable
- Perfect in Itself
- Unchanging
- Timeless
- Invisible



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Kant

Reality “as it is in itself”

- Absolutely Unknowable
- Possibly a realm of free actions
- Non-sensible

The Appearance of Reality

- Partially Knowable
- Imperfect
- Changing
- Temporal
- Visible



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The “Mere Appearance” of Reality

- Perfectly Knowable
- Here Newton’s physics is true.
- Actions and choices completely determined by physical causes and laws.
- Sensible

Kant on Newton on Time and Space

- “Those [Newton and his followers], however, who assert the absolute reality of space and time, whether they assume it to be subsisting or only inhering, must themselves come into conflict with the principles of experience. For if they decide in favor of the first (which is generally the position of the mathematical investigators of nature), then they must assume two eternal and infinite self-subsisting non-entities (space and time), which exist (yet without there being anything real) only in order to comprehend everything real within themselves.” (pp. 183-4)

Kant on Leibniz on Time and Space

- “If they adopt the second position (as do some metaphysicians of nature) [Leibniz, Wolff], and hold space and time to be relations of appearances (next to or successive to one another) that are abstracted from experience though confusedly represented in this abstraction, then they must dispute the validity or at least the apodictic certainty of *a priori* mathematical doctrines in regard to real things (e.g., in space), since this certainty does not occur *a posteriori*, and on this view the *a priori* concepts of space and time are only creatures of the imagination, the origin of which must really be sought in experience, out of whose abstracted relations imagination has made something that, to be sure, contains what is general in them but that cannot occur without the restrictions that nature has attached to them.”
(p. 184)

Kant on Space

The Transcendental Aesthetic,
First Section, On Space
[Von dem Raume]
(pp. 174-8).

Proofs that the character of space is *a priori*.

- 1. Space is needed to think objects in relation to each other.
- "Space is not an empirical concept which has been derived from outer experiences. For in order that certain sensations to be related to something outside me (i. e., to something in another region of space from that in which I find myself) thus in order for me to represent them as outside <and next to> one another, thus not merely as different, but as in different places, the representation of space must already be their ground." (p. 174-5)

Proofs that the character of space is *a priori*.

- 2. "One can never represent that there is no space, although one can very well think that there are no objects to be encountered in it." (p. 175)
- It must therefore be regarded as the condition of the possibility of appearances, and not as a determination dependent upon them. It is an *a priori* representation, which necessarily underlies outer appearances.

Proofs that the space is particular.

- 3. "Space is not a discursive or, as is said, general concept of relations of things in general, but a pure intuition."
- Our imagination, Kant believes, can picture only a single space, of which all spaces which can be pictured are parts. "It [space] is essentially single." (p. 175)

Proofs that the space is particular.

- 4. Space can be split up into parts in a way in which only particulars, and not also general notions, can be divided. Space therefore is also a particular. Kant says (p. 175) that a concept contains a number of representations *under* itself. i.e., there may be an infinite number of horses. But space contains an infinite number of representations *within* itself. (p. 175)
- Recall that intuitions are singular and given. They are not abstracted.

The transcendental exposition of the concept of space

- Since space is an *a priori* particular, judgments based, i. e. geometrical judgments, on it, remain the product of synthetic *a priori* reasoning. This explains why judgments of geometry are necessary and universal. (p. 176)
- But what of alternative geometries built on non-traditional interpretations of Euclid's fifth postulate, i. e. non-Euclidean geometries, such as hyperbolic geometry, elliptic geometry and non-metric geometries? They are necessary and universal but are they *a priori* synthetic?

Is Space Real? It is empirically real, but transcendently ideal

- Space is a form of the sensibility according to which we perceive the world. But, the form is subjective.
- "We can accordingly speak of space, extended beings, and so on, only from the human standpoint." (p. 177) "For we cannot judge at all whether the intuitions of other thinking beings are bound to the same conditions as those which limit our intuition and that are universally valid for us." (p. 177)

Kant on Time

The Transcendental Aesthetic,
Second Section, On Time
[*Von der Zeit*]
(pp. 178-192).

Proofs that time is experienced *a priori*

- 1. "Only under its presupposition can one represent that several things exist at one and the same time (simultaneously) or in different times (successively)." (p. 178)
- 2. "Time is a necessary representation that grounds all intuitions. In regard to appearance in general one cannot remove time, though one can very well take the appearances from time. Time is therefore given *a priori*. In it alone is all actuality of appearances possible. The latter could all disappear, but time itself (as the universal condition of their possibility) cannot be removed" (p. 178)

Proofs that time is particular

- 3. "It [Time] has only one dimension: different times are not simultaneous but successive just as difference spaces are not successive but simultaneous." So, since there is one time, and it is given, it is a particular, an indication that it is an intuition. (p. 179)
- 4. "Further, the proposition that different times cannot be simultaneous is not to be derived from a general concept. The proposition is synthetic, and cannot arise from concepts alone." (p. 179)

Proofs that time is particular

- 5. “The infinitude of time signifies nothing more than that every determinate magnitude of time is only possible through limitations of a single time grounding it. The original **representation time** must therefore be given as unlimited. But where the parts themselves and every magnitude of an object can be determinately represented only through limitation, there the entire representation cannot be given through concepts, for they contain only partial representations», but immediate intuition must ground them.” (p. 179)

Time is transcendently ideal

- 6. As in the case with space, Kant declares that time is empirically real, i.e., if we suppose that there is actually succession and simultaneity in the world, then time is real.
- But he disputes that we are justified in assigning time 'absolute' reality. "Such properties, which pertain to things in themselves can never be given to us through the senses." We cannot know this. We must hold that time is transcendently ideal. (p. 182)

How Space and Time are Empirical Real but Transcendentally Ideal: Kant's Examples

- “We ordinarily distinguish quite well between that which is essentially attached to the intuition of appearances, and is valid for every human sense in general, and that which pertains to them only contingently because it is not valid for the relation of sensibility in general but only for a particular situation or organization of this or that sense. And thus one calls the first cognition one that represents the object in itself, but the second one only its appearance.” p. 186 [continues]

How Space and Time are Empirical Real but Transcendentally Ideal: Kant's Examples

- “. . . . Thus, we would certainly call a rainbow a mere appearance in a sun-shower, but would call this rain the thing in itself, and this is correct, as long as we understand the latter concept in a merely physical sense, as that which in universal experience and all different positions relative to the senses is always determined thus and not otherwise in intuition. But if we consider this empirical object in general and, without turning to its agreement with every human sense, . . . (continues, p. 187)

How Space and Time are Empirical Real but Transcendentally Ideal: Kant's Examples

- “ask whether it (not the raindrops, since these, as appearances, are already empirical objects) represents an object in itself, then the question of the relation of the representation to the object is transcendental, and not only these drops are mere appearances, but even their round form, indeed even the space through which they fall are nothing in themselves, but only mere modifications or foundations of our sensible intuition; the transcendental object, however, remains unknown to us. (p. 186)

Difference of 'Outer' and 'Inner' Sense'

- “By means of outer sense (a property of our mind) we represent to ourselves objects as outside us, and all as in space. In space their shape, magnitude, and relation to one another is determined, or determinable. Inner sense, by means of which the mind intuits itself, or its inner state, gives, to be sure, no intuition of the soul itself, as an object; yet it is still a determinate form, under which the intuition of its inner state is alone possible, so that everything that belongs to the inner determinations is represented in relations of time. Time can no more be intuited externally than space can be intuited as something in us. (p. 174)

To Say Sensibility is Founded on Appearances is Not to Say it is an Illusion

- “If I say: in space and time intuition represents both outer objects as well as the self-intuition of the mind as each affects our senses, i.e., as it **appears**, that is not to say that these objects would be a mere **illusion**. For in the appearance the objects/ indeed even properties that we attribute to them, are always regarded as something really given, only insofar as this property depends only on the kind of intuition of the subject in the relation of the given object to it then this object as **appearance** is to be distinguished from itself as object **in itself**.” (p. 190)

Summary

- How would you guys summarize Kant's view?
- What do you remember?

Summary

- Kant argues that space and time are merely formal features of how we perceive objects, **not things in themselves** that exist independently of us, or properties or relations among them.
- Objects in space and time are said to be “**appearances**”, and he argues that we know nothing of substance about the things in themselves of which they are appearances. Kant calls this doctrine (or set of doctrines) “transcendental idealism.”

Summary

- Transcendental idealism in Kantian philosophy has sparked extensive debate among readers, leading to varying interpretations.
- Phenomenalism View: Some scholars, including Kant's contemporaries, perceive transcendental idealism as a form of phenomenalism, resembling Berkeley's philosophy, which asserts that reality is grounded in our perceptions.
- Non-Metaphysical Interpretation: Conversely, others argue that transcendental idealism is not a metaphysical or ontological theory, suggesting alternative perspectives.
- BUT, *so little consensus...*

Concluding Remark

- Kant argues for a surprising set of claims about space, time, and objects:
- Space and time are merely the **forms** of our sensible intuition of objects. They are not beings that exist independently of our intuition (things in themselves), nor are they properties of, nor relations among, such beings. (A26, A33)

Concluding Remark

- The objects we **intuit** in space and time are **appearances**, not objects that exist independently of our intuition (things in themselves). This is also true of the mental states we intuit in introspection; in “inner sense” (introspective awareness of my inner states) I intuit only how I appear to myself, not how I am “in myself”. (A37–8, A42)

Concluding Remark

- We can only **cognize** objects that we can, in principle, **intuit**. Consequently, we can only cognize objects in space and time, appearances. We cannot cognize things in themselves. (A239)
- Nonetheless, we can think about things in themselves using the categories (A254).
- Things in themselves affect us, activating our sensible faculty (A190, A387)

Concluding Remark

- In the “Fourth Paralogism” Kant defines “transcendental idealism”:
- I understand by the transcendental idealism of all appearances [*Erscheinungen*] the doctrine that they are all together to be regarded as mere representations and not as things in themselves [*nicht als Dinge an sich selbst ansehen*], and accordingly that space and time are only sensible forms of our intuition, but not determinations given for themselves or conditions of objects as things in themselves [*als Dinge an sich selbst*]. (A369; the *Critique* is quoted from the Guyer & Wood translation (1998))

Interpretive questions

- 1. The nature of appearances.
- Are they (as Kant sometimes suggests) identical to representations, i.e., states of our minds? If so, does Kant follow Berkeley in equating bodies (objects in space) with ideas (representations)? If not, what are they, and what relation do they have to our representations of them?

Interpretive questions

- 2. The nature of things in themselves.
- What can we say positively about them? What does it mean that they are not in space and time? How is this claim compatible with the doctrine that we cannot know anything about them? How is the claim that they affect us compatible with that doctrine? Is Kant committed to the *existence* of things in themselves, or is the concept of a “thing in itself” merely the concept of a way objects might be (for all we know)?

Interpretive questions

- 3. The relation of things in themselves to appearances.
- Is the appearance/thing in itself distinction an ontological one between two different kinds of objects? If not, is it a distinction between two aspects of one and the same kind of object? Or perhaps an adverbial distinction between two different ways of considering the same objects?

Another problem

- Kant thought that Euclidean geometry was synthetic *a priori* knowledge: that it was both genuinely informative and necessarily true.
- The presence of consistent non-Euclidean geometries challenges the idea that Euclidean geometry is a logical necessity.
- The only aspect of pure geometry that possesses logical necessity is the derivation of theorems from axioms.
- The process of testing the validity of theorems from axioms in pure geometry is based on *a priori* reasoning rather than empirical experience.

Another problem

- Kant's concept of *a priori* knowledge includes the belief that Euclidean geometry accurately describes the "form of experience."
- One way to interpret this is by asserting that all our experiences and concepts of space must always adhere to Euclidean geometry, as it is difficult to conceive a three-dimensional non-Euclidean space.
- However, experimental tests, such as Gauss's, seem to rely on the possibility of experiencing non-Euclidean geometry, contradicting the claim that all our experiences must be Euclidean.

Handedness – Tutorials on Sunday

- On Sunday, please discuss the following:
- 1. Explain the handedness argument that is proposed by Kant in the required reading in groups (I will put you guys into groups during class), you can use Kant's own example or **come up with your own example** to explain.
- Can you think of other arguments based on the notion of incongruent counterparts that are more successful against the relationist?

Handedness – Tutorials on Sunday

- 2. Kant makes a further suggestion in the essay, one that is not fully developed but which has received a lot of attention: He points out that many natural phenomena (beans growing around poles, hair growing in a spiral) have a certain handedness — clockwise and anticlockwise are incongruent counterparts, and nature seems to pick one. So maybe the laws themselves have a handedness. Could this be given a relationist explanation? Could the absolutist do any better?