H2 Knowledge and Inquiry

Arguments and Evidence

Adapted from Copy of Arguments and Evidence by @niuniuclub

GENERAL EPISTEMOLOGY

Argument	Example	
☐ **Criteria for "Good" Knowledge**		
Scope	**"All bachelors are unmarried"** ● We might know that "all bachelors are unmarried" with complete **certainty** — but such tautologies seem to have less epistemic value, because they don't tell us anything *new*: if we knew what a bachelor was, we would already know this analytic truth that all bachelors are unmarried!	
Usefulness	**William James' Pragmatism** ● We seem to value knowledge over mere beliefs because it seems to be useful or profitable in our lives — we want to know whether it is 7am rather than just believe it to be the case, so we can accurately decide whether we have time to eat breakfast without being late for work! ● That's why some scholars like William James have even defined truth as pragmatism!	
Certainty, to be useful	**Pythagoras' Theorem** ● This mathematical theorem has a lot of epistemic and pragmatic value, because we have deductively derived it from Euclid's axioms — this is certain, with no possibility of error! ● This certainty allows us to **apply it to all right-angled triangles**, without worrying that it will give us a false result — it is useful, both in our everyday lives and also in the **construction of new knowledge in geometry**.	
Reliability, to be useful	**Gambler and the roulette wheel** ● The gambler's belief that the ball will next land on red is not useful, because it is not derived by a reliable process — he will one day be wrong!	**V=IR** ● This law in physics has a lot of utility because it is reliable — we have verified through many experiments that multiplying the current and resistance does indeed give us the voltage, allowing us to safely use that equation to design circuits and electronic devices. **Golden Cross** - Since 1950, the S&P 500 has experienced 36 different golden crosses. About 80% of the time, stocks are higher a year later, with an average return of about 10%.
Objectivity / Universality, to be useful	**Moral knowledge** ● The reason philosophers continue to search for objective and universal moral knowledge — such as Kant's attempts to formulate a Categorical Imperative	

	— is because such objectivity and universality would make moral knowledge particularly useful in guiding our behaviour, since we would have rules and principles we could apply in all instances. In fact, we would be able to eradicate all moral disagreement! ○ "Act as if the maxim of your action were to become through your will a universal law of nature."
Coherent, to be useful	**Rise of Hitler** ● Even if we could objectively discover all the facts relating to Hitler's rise and list objectively all the reasons for his rise to power, this would be of little value to us: it would be a meaningless compilation of facts that do not fit into a 'coherent' narrative that 'makes sense' to us. Hence, history will have failed in its desire to help us understand the past and **learn from it!** ● By attributing Hitler's rise to power to the popular appeal of his fascist ideology, even if it neglects other causes like Jewish economic privilege or the role of propaganda, it tells us a far more useful insight into our past that we can learn from: that we need to purge such noxious ideologies from civil discourse!
☑ ~~**Types of Knowledge**~~	
Propositional / Know-that知道	**"The man is spouting nonsense"** ● Propositional knowledge can be expressed in "that" clauses: "that the man is spouting nonsense", for instance. ● It can be clearly true or false!
Practical / Know-how	**"I know how to shit"** ● No propositions or beliefs involved here — it's a practical competency. ● I don't need to believe, or be aware of the fact that I know how to shit— if I produce shit, I know how to shit. ● No reason required here — a good example for experiential knowledge.
Acquaintance 认识	**"I know this street"** ● Knowledge by acquaintance is familiarity with a person, place, or thing, typically obtained through perceptual experience — for example, you might "know" the street you live on, even if you are not aware of that fact of your knowledge.
Modal	**Descartes' Mind and Body / Berkeley's Perception** ● While some claims pertain to actual facts, there are also claims about modal facts, about how things could, must, or could not have been. ○ Descartes: It is possible for the mind to exist without the body. ○ Berkeley: It is impossible for anything to exist unperceived. ● Of course, this raises questions of epistemic access (how do we access the modal realm?) and navigation (how do we navigate from one kind of modality, such as metaphysical modality, to another, such as conceptual modality.
Introspective	**"I am sad"** ● Introspective knowledge seems to be self-justifying — without an external, mind-independent reality to correspond to given that it concerns mental states, it seems that believing introspective claims appears to be sufficient justification for these beliefs to become knowledge. ● For instance, I can know that I am sad just by realising and believing it alone

	— few would ask me to produce further justification for my belief.
☑ ~~Internalism vs Externalism (Approaches to Justification)~~	
Internalism, because we can have justification even when there is no reliability in belief formation	**New Evil Demon Problem** ● Imagine a subject with beliefs and experiences identical to ours, but the subject is being systematically deceived by a malicious Cartesian demon so that all their beliefs turn out false. In spite of the subject's unfortunate deception, we do not think this subject ceases to be rational in taking things to be as they appear as we do. ○ After all, it is possible that we could be radically deceived in the same way, yet we are still justified in holding most of our beliefs in spite of this possibility. ● Surely, then, justification must be an internalist matter.
Not internalism, because a believer being justified is different from a belief being justified	**New Evil Demon Problem** ● Well, a believer being justified is different from a belief being justified: ○ In asserting that a believer is justified, we are asserting that the believer does not hold the beliefs she does because of some defect in her. ○ In asserting that a belief is justified, we are asserting that there is not some defect in the belief or the means by which the belief is produced that should lead us to give up that belief. ● It may be the case that these deceived subjects are equally justified in holding their beliefs, but it is also intuitive to think that their beliefs themselves are not equally justified as ours, because the beliefs are produced by a defective, unreliable process of deception.
Externalism, because we attribute knowledge to people even if they do not 'know how they know'	**Compass** ● A seafarer in the 18th century might not fully understand why a compass enables him to navigate reliably — he might not have received extensive education about the earth's magnetic field and the properties of magnets ● However, we would still say that his knowledge of his bearings is justified, even if he does not possess any internal mental state, i.e. experiences the seafarer directly or introspectively possess, available to justify this knowledge! Hence, justification must be about something external to the subject — the objective relationship between justification and truth…
Externalism, because the connection of justification and truth renders beliefs objective (mind-independent)	**Litmus paper** ● We want justification to minimise epistemic error — this can only be the case if our justification has some correlational or causal relationship with the truth. In other words, our justification must make the belief objectively likely to be true. ● If one applies some liquid to a litmus paper and it turns red then the objective likelihood that the liquid is acidic is very high — and we would say that one knows the liquid is acidic. But the strong correlation between red litmus paper and acidity is not accessible by introspection and reflection alone. Rather, the strong correlation is known only through empirical testing, a fact existing independent of our internal mental states. ● So, if epistemic justification implies that one's belief is objectively likely to be true then justification is not determined entirely by one's internal states.
☑ ~~Need for Belief~~	

<table>
<tr><td>Ostensibly no, because belief is incompatible with knowledge due to a linguistic trick.</td><td>“I don’t believe I will win, I know I will win”
Belief implies 'ambivalence', or not being entirely sure about the proposition made, while knowledge implies 'sureness', so belief appears to be an inappropriate descriptor.
This is, however, a linguistic distinction: what one means to say is one doesn't just believe "p" but that "p" will be true, as an expression of confidence.
“I don’t just believe I will win, I know I will win.”
Hence, knowledge still requires belief.</td></tr>
<tr><td>Ostensibly no, because knowledge is more about how one acts than the beliefs one might hold. Hence, knowledge is separate from belief.</td><td>Kahoot Quiz
In a classroom quiz, one might guess the date of the fall of the Soviet Union in 1991, even if one does not "believe" it to be true, but we would still say they knew the answer. Hence, knowledge is separate from belief.
But we can treat actions as implicit reflections of / assents to beliefs! At least in a minimal sense. Hence, belief is necessary for knowledge.</td></tr>
<tr><td colspan="2">Link: While belief seems necessary to knowledge, it is not sufficient for knowledge when considering absurd propositions like the earth being flat. Mere belief of the earth as flat does not seem to count as knowledge because…</td></tr>
<tr><td colspan="2">☑ <s>Need for Truth</s></td></tr>
<tr><td>Yes, because we reject justified false beliefs</td><td>Flat Earth
It may well have been justified to believe "the earth is flat" in the Middle Ages, given that we gain reliable knowledge about the shapes of objects all the time using our visual senses.
But we would be very hesitant to say people in the Middle Ages knew "the earth is flat", since we have an abundance of better evidence that the earth is in fact round — in some fundamental way, you cannot know a false statement!
In other words, the people in the Middle Ages cannot be said to have knowledge because they have a false belief even though it seemed justified then. Hence, truth is necessary for knowledge.</td></tr>
<tr><td rowspan="2">Ostensibly no, because truth is inaccessible in empirical inquiry, leading to scepticism

For correspondent theory of truth.</td><td>Illusions
My senses have deceived me before and thus I cannot trust my senses except when I am viewing something in optimal conditions
Think about all kinds of optical illusions: the Troxler’s Fading Effect</td><td>Dreams
I dream in very good conditions and I cannot tell whether I am dreaming or awake, which means I can doubt the things I perceive through my senses.</td><td>Evil Demon / Brain in Vat
An evil demon can deceive me into thinking there are universal things like colour and arithmetic
Or I could be a brain floating in a vat, with my perceptions merely the product of electrical stimulations of my neurons!</td></tr>
<tr><td colspan="3">Kant’s phenomena / noumena distinction
Kant distinguishes between phenomena (what we perceive) and noumena</td></tr>
</table>

	(the unknowable thing in itself), arguing that we cannot epistemically access the noumenal realm ● Consider, for instance, colour vision — when we see a sunset, we might perceive this same colour differently — someone with red-green colour blindness might find this colour similar to that of plants, while the orange might look richer and more intense to someone with a heightened sensitivity to colour (i.e. tetrachromats). ● We cannot verify, therefore, if our perceptions of phenomena like colour really correspond to noumenal reality — to insist on truth, it seems, leads to scepticism
Ostensibly no, because justification approximates truth anyway	**"It is sunny today"** ● In everyday life, we don't seem to want to verify the truth value of all of our knowledge claims — justification seems to be sufficient for knowledge! ● If I saw the sun out and I felt a warm sensation on my skin, it could be said that I 'know' it to be sunny, even if there's a small chance I was being deceived by an evil demon — this is because most of the time, my senses reflect reality. Thus, justified belief appears to be 'good enough' for knowledge — since **truth is elusive**, justification can approximate truth.
Yes, for knowledge to be useful **For Pragmatic Theory of Truth**	**Golden Cross** ● We seem to value knowledge because it seems to be applicable or useful in our lives — that is why, for instance, some like William James have even defined truth as pragmatism! ● However, for many beliefs, a belief being true is a prerequisite for the belief being useful. ○ For instance, Golden Cross marking a bullish trend is only useful insofar as it is true, because it is only on this basis that we can reliably use the cross of short term moving average over long term moving average from below to enter a market for profits.
Yes, because belief implies a need for truth	**Moore's Paradox** ● The reason the Moore Paradox arises in the first place is because our beliefs pertain to truths in the world — when we believe "P" we also believe that "P is true", making it illogical to not believe what one claims to be true. ● If our beliefs are inherently connected to truth, it stands to reason that our conception of knowledge should account for this condition of truth.
Yes, because justification implies a need for truth	● Our need for justification is also tied to our quest for truth in knowledge — we want to arrive at our beliefs in the right kind of way so that we minimise the possibility of epistemic error, i.e. the possibility that our beliefs are false. ● Hence, justification is an attempt to secure the truth of our beliefs, making it natural for truth to be a condition for knowledge as well given that it is the end goal of what we seek in knowledge.
☑ ~~**Need for Justification**~~	

Yes, because we reject unjustified true beliefs that is caused by epistemic luck.	**The gambler and the roulette wheel** ● To identify true belief as knowledge is implausible, because a belief can be true even if formed improperly. ● A gambler that correctly believes the next number on the roulette wheel will be red can be said to have a true belief, but not knowledge. ● This seems to imply we require true beliefs to be obtained in the right 'sort of way' for them to constitute knowledge — true belief is not enough. ● We seem to require justification because we know that we cannot forever depend on beliefs to be true by chance — for instance, the gambler that guesses the colour of the next number on the roulette wheel will eventually make an error!
Ostensibly no, because justification is but a means to the end of truth	**Plato's Meno** ● Plato's Meno includes a famous discussion of the question of why knowing something is more valuable than just holding the correct opinion on it. The person who correctly guesses that the road to Larissa is to the left, the challenge goes, will get there just as well as the person who knows the way. So why value knowing?
Yes, because knowing how our beliefs are justified enables 'troubleshooting'	**Lawrence's future-telling boy** ● Consider D.H. Lawrence's example of a boy who can predict the future consistently by sitting on a rocking-horse — if his predictions turned out to be incorrect one day, we would not be able to identify what went wrong to fix his future-telling process. ● However, knowing that our scientific knowledge is derived through experimentation allows us to identify possible sources of error in those experiments! This enables 'troubleshooting' that creates epistemic progress.
Yes, because knowing the nature of justification enables epistemic progress	**Foundationalism in mathematics / reliabilism in science** ● Knowing the nature of justification points us towards the appropriate way / method of constructing knowledge in the field — and in so doing enables epistemic progress when we can develop ways to acquire more true beliefs. ○ For instance, knowing that mathematical justification is foundationalist in nature — with mathematical theorems built on foundational axioms — shows us that we should be working with deductive proofs from first principles in mathematics, not drawing shapes on a piece of paper and making observations. ○ For instance, knowing that scientific justification requires reliable processes shows us that we should be trying to create instruments or machines that enhance the reliability of our scientific inquiry — creating more precise colorimeters so we can detect the specific wavelengths of light, for example.
Concluding the JTB account: J, T, B are jointly necessary for knowledge, but individually insufficient.	
☑ ~~**Gettier Problems and Solutions**~~	
Gettier Problem	**Big Ben** ● Big Ben has been closed for repair. While walking around Westminster one day, I look up and see that Big Ben indicates the time to be 12pm, and I believe that it is 12pm. It happens to be the case that it really is noon at that moment, and ordinarily, looking at a clock would be sufficient justification for a belief about the time. ● But we would be hesitant to say that I *know* it is 12pm…

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<tr><td></td><td>Plato and Socrates (resolved by Fourth Condition)
Let it be assumed that Plato is next to you and you know him to be running, but you mistakenly believe that he is Socrates, so that you firmly believe that Socrates is running. However, let it be so that Socrates is in fact running in Rome; however, you do not know this.
Fake Barns (Unresolved by Fourth Condition)
Suppose you're driving through rural Pennsylvania. As a matter of fact, the region you're driving through contains a lot of fake barns: mere wooden fronts that just look like barns from the road. But you don't know this, and have no reason to suspect it.
You look off to your left and you see something that looks like a barn, so you believe "That's a barn." In fact, it is a barn. It's one of the few barns in the region.
But you're just lucky. If you had looked at a fake barn instead, you would have believed that it was a barn.</td></tr>
<tr><td colspan="2">Rejoinder approaches:
Strengthen J to rule out Gettier cases as cases of justified beliefs.
Add a Fourth condition, to prevent JTB from being “Gettiered”.</td></tr>
<tr><td>Not infallibilism, as it is impractical to know so little.</td><td>“S's justification guarantees the truth of P.”
So far, Gettier-style counterexamples work because the believer only has reasonable justification. But reasonable justification can still result in beliefs that are true by luck. EG Big Ben.
To resolve this issue, knowledge should require more robust justification, such that S’s justification guarantees the truth of propositions. We should only count beliefs that cannot be rationally doubted as knowledge.
For example, all bachelors are unmarried men has the predicate of unmarried men contained in the subject that all bachelors are unmarried men. The proposition being definitionally true is thus robust justification and thus the proposition can be counted as knowledge. Other examples like “My head hurts” and “2+2=4” cannot be rationally doubted since they are internal to the speaker and was deductively arrived at by mathematical axioms respectively. These beliefs are infallible and not subject to luck.
In contrast, nowhere in the predicate that the clock exactly shows the right time is contained in the spoiled Big Ben, the subject. Hence, the Big Ben Gettier case is resolved with infallibilism.
Problem: However, a lot of our knowledge relies on fallible justification. For example, our senses. There is always a chance that we could be dreaming. Since we are not prepared to accept that we know very little, only definitional truths that is not very practical in real life, infalliblism as a requirement for justification is too high a bar.</td></tr>
<tr><td>Fourth Condition does not resolve the Gettier Problem*</td><td>“S’s belief that p is not inferred from any falsehood.”
The fourth condition is unsatisfied for the Plato Socrates example, since the speaker inferred the falsehood that the man running before him was Socrates and not Plato. The fourth condition rightly rejects the speaker’s belief as knowledge.
But there are scenarios where the fourth condition is satisfied, but the speaker’s belief is not knowledge.
“There is a dog in the field”
Suppose that S claims that there is a dog in the field. Unbeknownst to him,</td></tr>
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<tr><td></td><td colspan="3">there is a robotics company that has deployed a dog as lifelike and similar to a real dog as possible, to which S had referred to in his knowledge claim. Also unknown to S is the fact that there is also another dog - this time real - but concealed from S's view.
● S's belief is true, as there is a real dog in the field.
● S is also justified, since he based his belief on ordinary perceptual processes.
● S's belief appears to be true only due to luck, in a way inconsistent with knowledge. However, S fulfils the fourth condition, since his belief is directly justified by a visual experience, so he had not made an inference from any falsehood.
● If so, then the JTB account, even with the fourth condition, gives us the wrong result that S knows that "There is a dog in the field."</td></tr>
<tr><td>Gettier-style uncertainty is just something we have to accept…</td><td colspan="3">● All the proposed solutions to Gettier problems center on one objective — to continue to eliminate epistemic luck.
● But if we continue to pursue epistemic certainty, we can only gain limited knowledge:
○ Analytic truths, e.g. "all bachelors are unmarried"
○ Basic claims demonstrated by transcendental arguments, e.g. "I exist"
○ Empirical knowledge cannot be certain because of the possibility of sense deception / evil-demon deception etc. — we fall into the trap of solipsism!
● This is no way to live — we will be paralysed from action, if we truly take the position that we have no knowledge! How do I tell the time, if every time I look at a clock, I fear that it has actually stopped and it is showing the right time only by accident? How do I eat an apple, if I constantly need to consider if it is actually a plastic prop someone placed there to deceive me?
● Insofar as we need to have knowledge to live our lives, we cannot discard all knowledge — we must accept the uncertainty that comes with it.</td></tr>
<tr><td colspan="4">☑ <s>Scepticism</s></td></tr>
<tr><td rowspan="2">Descartes: Doubting methodologies</td><td>Illusions
● My senses have deceived me before and thus I cannot trust my senses except when I am viewing something in optimal conditions
● Think about all kinds of optical illusions: the Troxler's Fading Effect</td><td>Dreams
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● Or I could be a brain floating in a vat, with my perceptions merely the product of electrical stimulations of my neurons!</td></tr>
<tr><td colspan="3">How can we know that the evil demon hypothesis is false? External world skepticism is the view that that knowledge (or justified belief) about the external</td></tr>
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	world is impossible. An external world skeptic is a *Cartesian skeptic* if they appeal to skeptical hypotheses in order to show that we cannot know (or justifiably believe) anything about the external world. The *Cartesian skeptical argument* is often presented as follows: (1) If you know that an external world proposition P is true, then you know that the skeptical hypothesis SH is false. But (2) you don't know that SH is false. Therefore, (3) you do not know that P.	
Kant: Doubting perception	**Kant's phenomena / noumena distinction** ● Kant distinguishes between phenomena (what we perceive) and noumena (the unknowable thing in itself), arguing that we cannot epistemically access the noumenal realm ● Consider, for instance, colour vision — when we see a sunset, we might perceive this same colour differently — someone with red-green colour blindness might find this colour similar to that of plants, while the orange might look richer and more intense to someone with a heightened sensitivity to colour (i.e. tetrachromats). ● We cannot verify, therefore, if our perceptions of phenomena like colour really correspond to noumenal reality.	
Hume: Doubting causation	**Falling leaf** ● We only see a constant conjunction of events, but to attribute causal relationships succumbs to the fallacy of post hoc ergo propter hoc ● We only conceive of "cause and effect" due to repeated experiences, inductive extrapolation and habit, succumbing to the problem of induction ○ Just because a leaf has always fallen to the ground after I have let go, it does not mean that my letting go necessarily causes it to fall to the ground	
Agrippa: Doubting justification	**Trilemma** ● There are only three ways of completing a proof: ○ The circular argument, in which the proof of some proposition presupposes the truth of that very proposition ○ The regressive argument, in which each proof requires a further proof, ad infinitum ○ The dogmatic argument, which rests on accepted precepts which are merely asserted rather than defended ● The trilemma, then, is the decision among the three equally unsatisfying options. If all are unsatisfactory, we can't seem to acquire justified beliefs.	
***Ostensibly* no, because of transcendental arguments / the incorrigibiity of sense**	**Descartes' Cogito Ergo Sum** ● Often, X is presupposed by the sceptical attack that doubts X ● Descartes recognises this	**Sense experience** ● Often, X is presupposed by the sceptical attack that doubts X ● For instance, the doubt that one is aware of having experiences is in itself

data	in his famous Cogito Ergo Sum: to doubt that one exists, one must exist to doubt!	an experience that one is aware of ● In this way, sense data is *incorrigible*
***Ostensibly* no, because of analytic truths and tautologies**	**"All bachelors are unmarried"** ● Given that analytic statements have predicates contained in their subjects, negating them would lead to a contradiction — for instance, it is indubitable that bachelors are unmarried, because the very *definition* of a bachelor is that he is unmarried ● Therefore, some analytic truths can be obtained with certainty — although they're not very useful!	
Stroud's Objection to Transcendental Arguments	**Cogito / Logical necessity** ● Transcendental arguments demonstrate psychological necessities but do not imply metaphysical necessities - beliefs holding true in any possible world or scenario. ● It might seem to us, as "I", that it is impossible to doubt that one exists (psychological reality), but the "I" that doubts could just be a string of thoughts (metaphysical reality) - contrary to what we intuitively think of self as a unified entity with a soul. ● It might seem to us that we must think in a logically consistent manner (psychological necessity), but the world might not actually be logically consistent (metaphysical necessity). This is supported by quantum logic and distributivity point, see below.	
Non-necessity of logical 'laws' **I like this.**	**Quantum logic and distributivity** ● For centuries, it seemed to us that fundamental logical principles must necessarily be the case. However, we learnt that some principles in classical logic fail to apply in the quantum realm: the law of distributivity was abandoned in quantum logic ● Hence, what seems to us to be logical necessities need not be the case in 'real life', making the truth of even tautologies — founded on these logical principles — open to doubt	
Stove's statistical defence of induction	**Coin flips** ● It is a statistical truth that a sample of sufficient size will be similar to the population from which it is drawn ● If you flip a coin 100 times, it is overwhelmingly likely that the number of heads you get will approach 50, reflecting the true probability of getting a head ● As long as you have no reason to think that your sample is an unrepresentative one, you are justified in thinking that probably (although not certainly) that it is	
No, because of epistemic circularity	**Attack of Global Scepticism** ● "All beliefs are doubtful" is a belief that is itself doubtful ● Not all beliefs can be doubted at once: doubting one set of beliefs requires us to take another set of beliefs for granted	
No, because of Wittgenstein's Appeal to Ordinary Language	**"Knowing"** ● Sceptics are asking us to buy into a radically different meaning of "knowing" that is too far departed from the ordinary meaning of "knowing" ● Ordinarily, seeing the colour of a table is enough justification to "know" the	

	colour of the table, and any sceptic that seeks to question that justification invites a radical departure from what "knowing" is ● Words are meaningful because there is social agreement about their meaning, so to rip the word "knowing" from their context would be to talk nonsense	
No, because of Moore's Appeal to Common Sense	**"Here is one hand"** ● Famously, Moore refuted sceptical positions by raising his right hand and saying "here is one hand" — a claim we seem to be able to *know*. ● The epistemic principle behind this is that we have better justification for the claim that "here is one hand" than any of the premises in sceptical arguments. ● In the event that a sceptical argument calls into question beliefs we hold to be true by common sense, it would be more reasonable to jettison the argument rather than jettison the belief.	
No, because we don't want to fall into the trap of solipsism	● If we require justificatory certainty, we can only gain limited knowledge: ○ Analytic truths, e.g. "all bachelors are unmarried" ○ Basic claims demonstrated by transcendental arguments, e.g. "I exist" ○ Empirical knowledge cannot be certain because of the possibility of sense deception / evil-demon deception etc. — we fall into the trap of solipsism! ● This is no way to live — we will be paralysed from action, if we truly take the position that we have no knowledge! How do we take a step if we don't know the floor will not collapse? How do we eat if we don't know we're being served actual food rather than the holograms conjured by an evil demon? How do we escape from a predator if we don't know if our eyes are deceiving us? ● Insofar as we *need* to have knowledge to live our lives, we cannot discard all knowledge — we must accept the uncertainty that comes with it.	
Scepticism is still useful, because it can give us knowledge	**Cartesian scepticism** ● Cartesian scepticism is a methodology of doubt which questions the methods we use to acquire our beliefs, spurring philosophical inquiry and discovery ● This is what led Descartes into realising Cogito Ergo Sum!	**Proof by contradiction** ● Mathematicians often assume claims before deductively casting doubt on it to show how it leads to a contradiction: for instance, consider Euclid's proof of there being an infinite number of primes. ● Let there be a finite number of primes, p1, p2,p3,p4,...pn ● Let Q be the product of all primes in the list of finite number of primes plus one. Q=p1p2p3p4p5…pn+1. Q is either prime or not prime. ● Q is either prime or not prime. ● Q is divisible by itself and 1. While the primes in Q divide only by itself and 1, Q will always have a remainder of 1 when divided by any prime number. Hence Q is prime. ● Therefore, the claim that there is a finite number of primes is false, there are an infinite number of primes.

<table>
<tr><td colspan="3">☑ ~~Nature of Truth~~</td></tr>
<tr><td>Correspondent, because its intuitive</td><td colspan="2">“That man is wearing a hat” because we see that he is wearing a hat.
We often understand truth to be reflective of an external reality (to the 'facts', situation, or ‘state-of-affairs’)
If a friend says “that man is wearing a hat”, for example, you would immediately evaluate the truth of that claim by looking for the man and observing what he is wearing.
You would not, for instance, ask other passers-by if that man is wearing a hat, nor would you think about whether this is pragmatic / useful to believe.</td></tr>
<tr><td>Not correspondent, because we lack an external reality to be corresponded to / Berkeley’s Likeness Principle</td><td colspan="2">“The Mona Lisa is beautiful”
When we say it is true that the Mona Lisa is beautiful, is it really the case that we mean “the Mona Lisa’s properties corresponds to the concept of beauty”? This is a bizarre claim, because of Berkeley’s likeness principle: two objects can only correspond to each other if they are of the same nature, but abstract ideas like beauty are fundamentally different in nature from concrete, tangible objects like the Mona Lisa in the external world.
Hence, perhaps we mean truth in a different sense — not that it corresponds to an external reality.</td></tr>
<tr><td>Not correspondent, because we cannot verify correspondence</td><td>Trolley Problem
Perhaps you could say an ethical claim is true if it correspondents to a set of abstract moral facts, but this is not a fruitful conception of truth insofar as we <u>cannot access this abstract, moral realm.</u>
For instance, how would you verify if the claim that we should pull the lever in Philippa Foot’s Trolley Problem corresponds to the ‘moral reality’? We lack epistemic access to this moral realm.
In this way, we need another conception of truth that we can actually apply to claims — not one that leaves the truth value of many claims permanently indeterminate.</td><td>Kant’s phenomena / noumena distinction
Kant distinguishes between phenomena (what we perceive) and noumena (the unknowable thing in itself), arguing that we cannot epistemically access the noumenal realm
Consider, for instance, colour vision — when we see a sunset, we might perceive this same colour differently — someone with red-green colour blindness might find this colour similar to that of plants, while the orange might look richer and more intense to someone with a heightened sensitivity to colour (i.e. tetrachromats).
We cannot verify, therefore, if our perceptions of phenomena like colour really correspond to noumenal reality.</td></tr>
<tr><td colspan="3">Link: As such, I argue that another theory of truth, the coherence theory of truth is a better theory as it not only accounts for how we construct and revise beliefs, but also avoids the verifiablity problem that plagues correspondence theorists - truth conditions need not be based on the external reality. The stronger and more popular version of coherentism states that X is true, not only that it is consistent with other established beliefs but also that it is logically entailed - deductively or inductively - by other established beliefs.</td></tr>
</table>

Coherentist, because it accounts for how we construct and revise beliefs	**Journalism / Criminal investigations** ● Coherentism seems to describe how we acquire beliefs: in journalism, where sources are corroborated with one another, or in criminal investigations, where testimonies are checked for coherence.
Coherentist, because it accounts for OA that (propositions possibly corresponding with objective facts in an external reality so correspondence theory need not be rejected wholly).	Advocates of the correspondence theory of truth argue that even if propositions cannot be known to correspond to objective facts in an external reality, propositions might still cohere with objective facts. I argue that propositions cannot correspond to objective facts if we cannot verify our perceptions of phenomena. Speakers assert their propositions - giving it the status of truth - under conditions the speakers are able to recognise as justifying the proposition. Given the proposition that "the cat is black", and granting that we cannot verify our perceptions of phenomena, the only conditions that speakers can recognise as justifying the proposition are the conditions under which it coheres with their beliefs. When the speakers make a practice of asserting their propositions under these conditions, they become the proposition's truth conditions.
Not coherentist, because of contradictory truths.	***Black Panther*** ● It is possible to have two systems of belief, each one logically consistent and entails each other, but each incompatible with one another. ● Marvel's Black Panther creates a coherent world: "Wakanda is prosperous", "Wakanda has vibranium", and "Wakanda's Black Panther has superpowers" all cohere with one another. ● Unfortunately, none of these statements are true — Wakanda is a fictional state, and fictions by definition are made-up and not true! Since coherent systems can be false, truth is not coherentist.
Pragmatic, because it reflects why we value truth	**Blood types** ● We seem to value knowledge because it seems to be applicable or useful in our lives — for instance, we value knowledge about human blood types, because it allows us to provide blood transfusions without the risk of incompatibility and blood clotting. ● Hence, a pragmatic understanding of truth seems to capture what we truly value about knowledge — that it can be *used* and applied in our daily lives.
Not pragmatic, because tautologies are useless but still true	**"All bachelors are unmarried"** ● To know that all bachelors are unmarried is not a useful piece of information — as an analytic statement, a bachelor must be unmarried by definition. ● However, we still say that this statement is *true* in some fundamental sense, even if it offers us little pragmatic value in our lives — so truth must be a property that extends beyond whether a belief is useful!
Not pragmatic, because who decides what is pragmatic?	*"an idea is "true" so long as to believe it is profitable to **our** lives" — William James* **Slavery as "useful" to White slaveowners** ● Usefulness is a subjective concept — a belief can be useful to many different ends, that according to James' pragmatic theory of truth, is up to the individual or entity to define. ● "Slaves don't deserve rights" is a useful belief for many White slaveowners to hold — it allowed them to profit off free labour, after all. But we would not be comfortable with accepting this kind of relativity in truth — few would accept that "slaves don't deserve rights" even though it could be true to some if they

	benefitted from it!
Correspondent or coherentist, depending on the aims of the field of knowledge	**Correspondence in science / coherentism in history** ● In science, we need correspondence for truth — V=IR is only useful insofar as it corresponds to the actual relationship between the three variables, because it is only on this basis that we can safely use that equation to design circuits and electronic devices. ○ Conversely, when Lysenko rejected Mendelian genetics in favour of the belief that organisms could pass on traits acquired through use or disuse in their lifetimes, he created famines that killed millions because his belief did not correspond to how genetics actually worked ● In history, however, we only need coherence for truth — not just because we cannot verify whether our accounts exactly correspond to the events of the past since we cannot turn back time, but also because all we want is a coherent narrative to learn from. ○ By attributing Hitler's rise to power to the popular appeal of his fascist ideology, even if it neglects other causes like Jewish economic privilege or the role of propaganda, it tells us a far more useful insight into our past that we can learn from: that we need to purge such noxious ideologies from civil discourse!
Nature of Justification / Source of Knowledge	
Consider non-propositional knowledge too!	
Rationalism states that the ultimate source of knowledge is reason. Reason <u>alone</u> justifies knowledge. Empiricism states that the ultimate source of knowledge is experience. Experience <u>alone</u> justifies knowledge. Both positions claim that reason or experience forms the foundational building blocks of knowledge.	
Rationalist, because of the Argument from Recognition	**Dogs / Hume's missing shade of blue** ● We can recognise particular instances as part of a concept without full prior understanding of all the particular instances of that concept, so innate knowledge of the concept must exist ● We can recognise a Chihuahua as a dog without having encountered all dog breeds ● For instance, consider Hume's missing shade of blue: when presented with a spectrum of colours from light blue to dark blue with just a shade missing, one can — without having seen that shade — infer and imagine what that shade of blue would be.
Rationalist, because of the Argument from Universals	**Dogs** ● The concept of something would still exist independent of the physical instantiations of the thing, hence innate knowledge of the thing exists ● If we took away all dogs from the world, the concept of the dog would still exists
Rationalist, because of the Argument from Perfection	**Perfect circle** ● If nothing in the world is perfect, but we have the idea of perfection, we must have innate ideas. ● We do have the ability to imagine that which is perfect — consider how we are able to imagine a perfect circle, even when all our circles in the real world are largely imperfect!
Rationalist, because of a priori	**Slave in Plato's "Meno"** ● A slave with no mathematical education could derive facts about the area of

mathematical facts	the square through dialogue alone ● Hence, such mathematical knowledge is a priori, derived from reason rather than any experience — some knowledge must come from reason, then!
Empiricist, because of rationalism's limited scope	**"All bachelors are unmarried"** ● We might know that "all bachelors are unmarried" through reason — but such tautologies acquired rationally don't seem to be very useful, because they don't tell us anything about the world!
Empiricist, because of Quine's attack of analyticity	**Quine's "Two Dogmas of Empiricism"** ● Analytic truths are merely circular, because they can only be justified using the concept of analyticity ○ Examining what subjects and predicates refer to does not work, because it confuses extension (what it refers to in the real world) and intension (what it means) ○ "Animals that have hearts" and "animals that have kidneys" refer to the same animals, but clearly mean different things ● We can only use cognitive synonymy to explain analytic truths, but to understand synonymy requires the presupposed understanding of analycity. ● Therefore, analytic knowledge (i.e. beliefs that are necessarily true) collapses — we only have synthetic knowledge, derived from the world!
Empiricist, because of the Argument from Tabula Rasa	**Babies learning mathematics by degrees** ● Babies' minds are tabula rasa that gain knowledge by degrees incrementally ● The fact that we learn mathematical concepts incrementally from addition to multiplication to algebra suggests that we had no settled, innate idea of mathematics
Empiricist, because of disagreements on 'innate ideas'	**Identity** ● Identity seems to be an 'innate idea' — we know from birth that we are one distinct self. ● However, different philosophers have different conceptions of identity and the self, such as the Cartesian 'unified self' vs the Humean 'bundle of thoughts'. How can these ideas be innate — clear and distinct — then?
Both rationalist and empiricist, because of Kant's Categories of Understanding	**Causation** ● Kant posits a priori categories of pure understanding that are presupposed to make sense of and experience events in the first place! ● If we did not have the innate understanding of what causation is, we would not be able to make sense of natural phenomena — we would not be able to understand not to touch hot objects, because we wouldn't understand that the burning pain we feel is a result of contact with the stove! ● Hence, reason is a prerequisite for experience — knowledge comes from a synthesis of the two.
Both rationalist and empiricist, because we need reason to identify the limitations of experience	**Refraction** ● When we observe a straw bending in water, we have many ways of explaining this phenomenon: it could be that our sight is deceiving us because of the way light rays refract, or it could be that objects really bend when they come into contact with water ● We need to apply our faculties of reason to decide which of these explanations to accept — to apply the principle of parsimony, judge how well each explanation coheres with our other knowledge, or even evaluate the reliability of our perceptual faculties in this instance, requires rational

	evaluation and judgement! *This argument can be applied to explain why reason undergirds knowledge construction even when coherentist or reliabilist standards of justification apply.*
Both rationalist and empiricist, because experience is needed for reason to engage in extrapolation	**Hume's missing shade of blue** ● Consider Hume's missing shade of blue: when presented with a spectrum of colours from light blue to dark blue with just a shade missing, one can — without having seen that shade — infer and imagine what that shade of blue would be. ● In this case, experience forms the foundation for reason to extrapolate concepts (e.g. shade and intensity) to fill in the gaps of knowledge.
Coherentist, because it accounts for how we construct and revise beliefs	**Journalism / Criminal investigations** ● Coherentism seems to describe how we acquire beliefs: in journalism, where sources are corroborated with one another, or in criminal investigations, where testimonies are checked for coherence.
Not coherentist, because of 'consistent fairytales'	***Black Panther*** ● Marvel's Black Panther creates a coherent world: "Wakanda is prosperous", "Wakanda has vibranium", and "Wakanda's Black Panther has superpowers" all cohere with one another. ● Unfortunately, none of these statements are true — Wakanda is a fictional state! Hence, coherent systems can also be totally false, making coherentist justification too easy to obtain.
Reliabilist, because we rely on truth-conducive processes we do not fully understand	**Compass** ● A seafarer in the 18th century might not fully understand why a compass enables him to navigate reliably — he might not have received extensive education about the earth's magnetic field and the properties of magnets ● However, we would still say that his knowledge of his bearings is justified because he is relying on a reliable process — even if he does not know why the process is reliable!
Not reliabilist, because we don't know how to determine truth-conduciveness	**"Sight is reliable"** ● To determine whether a belief-producing process is truth-conducive, we need to sample from a set of *instances* where that process was applied ● But we don't know how wide we should cast the net — if I am using my sight to look at the litmus test, what is the applicable set of instances that determine the reliability of this process? Is it only instances of me looking at litmus paper? Instances of me looking at things in the morning? Every time I have ever seen something?
Not reliabilist, because we cannot verify the truth of outputs in some fields	**Trolley Problem** ● To determine reliability, one needs to verify the truth value of a process's conclusions, which is not possible in some fields ● The truth of ethical claims cannot be tested in this manner, because the truth of those claims cannot be externally verified — how would you tell if your intuitions about the various versions of the Trolley Problem are reliable, if we don't have a correct answer against which we can check our intuitions?
Foundationalist, coherentist, or reliabilist —	**Foundationalism in mathematics / coherentism in history / reliabilism in science** ● Regardless of the specific structure of justification, they seem to serve the

depending on the field — so long as we mitigate epistemic luck	same purpose — to guard against epistemic luck and mitigate the possibility of error. ● Hence, perhaps any form of justification suffices, which can depend on the specific nature and construction of knowledge in the inquiry: ○ Mathematics: since we can proceed from mathematical axioms via logic to derive theorems, reason is a good foundation to justify our knowledge. ○ History: since we can only access the past through sources (we don't have a time machine), we can mitigate error in a coherentist fashion by comparing sources and corroborating their claims. ○ Science: since we want to study the natural world via repeated observations and tests, we can mitigate error by devising ways of making these observations and experiments more reliable (e.g. using accurate instruments, repeating the tests).
Not just reliabilist, because of Lehrer's Mr Truetemp	**Lehrer's Mr Truetemp** ● One seems to need to also be aware of the fact that the process is reliable ● Mr Truetemp has a tempucomp implanted in his brain that accurately reads the temperature and causes a spontaneous belief about the temperature — he is thus reliably forming true beliefs about temperature ● However, he is unjustified in believing these temperature beliefs because he is not aware of the tempucomp — reliability, on its own, is insufficient!
Nature of Perception	
Not direct realism, because of illusions and perceptual variation	**Illusions** ● Think about the Troxler's Fading Effect — or even the fact that pencils or straws appear to be broken when submerged in a glass of water! ● Thus, it cannot be the case that we <u>access reality directly</u>, unfiltered by perception.
Not anti-realism, because of the question of origin	**Morning assembly** ● During morning assemblies, all students can attest to having the sensory experience of hearing the national anthem and watching the national flag being raised. ● If there's no <u>mind-independent reality</u>, how would one explain why everyone experiences the same visual and auditory sensations, every single day?
Indirect realism, which creates relativism and subjectivity **(Mind-independent reality exists, just that we cannot access it directly.)**	**Colour vision** ● When we look at the same sunset, there really is a sun that is setting — and a specific wavelength of light corresponding to orange is really reaching each of our eyes. ● But we might perceive this same colour differently — someone with red-green colour blindness might find this colour similar to that of plants, while the orange might look richer and more intense to someone with a heightened sensitivity to colour (i.e. tetrachromats). ● In the same way that we will never know what it is like to be a bat (Nagel), we won't know how exactly others perceive the world, creating a degree of relativism and subjectivity. Our epistemic access is limited to the phenomenal realm (Kant) — the noumena is out of our reach.
Not indirect realism, because of Berkeley's Likeness Principle	**Berkeley's Likeness Principle** ● Two objects can only be compared if they are of the same nature, but abstract ideas are fundamentally different in nature from concrete, tangible

	objects in the external world. ● In this way, we cannot consider abstract ideas and experiences representations of the real world.
Analytic / Synthetic Distinction	
Hume's Fork	**Hume's Fork** ● There are two kinds of propositions: ○ Statements about ideas. These are analytic, necessary, and knowable a priori. ○ Statements about the world. These are synthetic, contingent, and knowable a posteriori.
Quine's attack on analyticity	**Quine's "Two Dogmas of Empiricism"** ● Analytic truths are merely circular, because they can only be justified using the concept of analyticity ○ Examining what subjects and predicates refer to does not work, because it confuses extension (what it refers to in the real world) and intension (what it means) ○ "Animals that have hearts" and "animals that have kidneys" refer to the same animals, but clearly mean different things ● We can only use cognitive synonymy to explain analytic truths, but to understand cognitive synonymy requires the presupposed understanding of analycity. ● Therefore, analytic knowledge (i.e. beliefs that are necessarily true) collapses — we only have synthetic knowledge, derived from the world!
Kant's synthetic a priori	**"Shortest distance is a straight line"** ● "A straight line is the shortest distance between two points" is synthetic because straight and shortest are not inherent to the predicate ● But we justify this using reason, not experience — in mathematics, we don't draw many paths on paper and measure the various distances, but rather discern this axiom using reason!

OVERVIEW

Property	Aesthetics	Ethics	History	Social Science	Science	Mathematics
Nature of Field						
Object of study	Aesthetic properties	Moral properties	The past	Social phenomena	Natural phenomena	Mathematical systems
Human involvement	High	High	High	High	Low	Low
Verifiability of truth	No	No	Limited	Limited	Mostly	No, in the Platonic sense Yes, in the Formalist sense
Complexity	High	High	High	High	Low	Low
Controllability	No	Yes, in thought experiments	No	No	Yes	Yes
Implications of error	Minimal	Severe	Moderate	Moderate	Severe	Severe

Property	Aesthetics	Ethics	History	Social Science	Science	Mathematics
Nature of Knowledge						
Nature of truth	—	Coherence	Correspondence, to facts Coherence, in narratives	Correspondence, in PSS Coherence, in ISS	Correspondence	Logic / Form
Nature of justification	Self-justifying, wrt. AJs Coherentist, wrt. art	Coherentist	Coherentist	Reliabilist, in PSS Coherentist, in ISS	Reliabilist Coherentist	Foundationalist
A priori / posteriori	A posteriori	A priori A posteriori, in application	A posteriori	A posteriori	A posteriori	A priori
Disagreement	High	High	High	High	Limited, only when underdetermined	Low
Influence of inquirer	High	High	High	High	Limited	No
Objectivity	No	No	Yes, in facts No, in narratives	No	Yes, but difficult	Yes
Certainty	Yes, wrt. self-knowledge Yes, wrt. self-justifying AJs	No	No	No	No	Yes, if axioms are granted
Construction of Knowledge						
Method	—	Thought experiments Reflective equilibrium	Historical	Scientific More quantitative, for PSS More qualitative, for ISS	Scientific	Axiomatic / Deduction
Reason	Yes, in aesthetic concepts	Yes	Yes	Yes	Yes	Yes
Observation **Experience** **Experimentation**	Yes	Only in application	Yes	Yes	Yes	No
Corroboration **Cross-referencing**	Yes, wrt. art No, wrt. AJs	Yes	Yes	Yes	Yes	Yes, but only for verification
Intuition	Yes	Yes	No, but useful as a guide	No, but useful as a guide	No, but useful as a guide	No, but useful as a guide
Use / Aims of Knowledge						
Desiderata	Promote *good* art	Prescribe behaviour	Understand the past Learn from past mistakes Predict future events	Predict behaviour, for PSS Capture meaning, for ISS Catalyse action, for CSS	Explain the natural world Facilitate innovation	Understand mathematical systems
Other applications	—	All human behaviour	—	—	Technology	Science Social Science
Justificatory threshold, before it can be useful	Intersubjectivity	Objectivity	Not certainty Some objectivity	Not certainty Some objectivity in PSS Intersubjectivity in ISS	Not certainty Reliability	Certainty

MATHEMATICS

Argument	Example(s)	
Nature of Mathematical Knowledge		
Analytic	**"1=1=2"** ● Consider the equation "1+1=2": negating this equation leads to a contradiction, since 2 is defined as the sum of 1 and 1 ● Hence, such mathematical knowledge is analytic in nature, true by virtue of its meaning / necessarily true	
Synthetic	**"Shortest distance is a straight line"** ● "A straight line is the shortest distance between two points" is synthetic because straight and shortest are not inherent to the predicate ● But we justify this using reason, not experience — in mathematics, we don't draw many paths on paper and measure the various distances, but rather discern this axiom using reason! ● The implication? The nature of Mathematical statements is not tautology: it gives us new and insightful knowledge of the relationship between numbers and symbols.	
A priori	**Slave in Plato's "Meno"** ● A slave with no mathematical education could derive facts about the area of the square through dialogue alone ● Hence, such mathematical knowledge is a priori, derived from reason rather than any experience	
Deductive / Certain	**Sum of Two Even Numbers is Even** ● If we accept the basic definition that even numbers are divisible by 2, the sum of 2 even numbers will be even ● Consider x and y as two even numbers. They can thus be expressed as x = 2a and y = 2b, where a and b are integers. Hence, x+y = 2a+2b = 2(a+b). Since a+b is an integer, x+y is divisible by 2, and is even. ● Hence, such mathematical knowledge necessarily follows from the basic axioms of mathematics we grant	
Not Inductive	**Riemann Hypothesis (Goldbach's conjecture)** ● 10 trillion non-trivial zeros have been checked, and all of them lie on the critical line x=½ ● However, the fact that we do not consider the Riemann Hypothesis solved suggests that inductive strength is not sufficient for mathematical justification — we require deductive certainty!	
Fallible / Dependent on Human Checking	**Jacobian Conjecture/ Wiles proof of Fermat's Last Theorem** ● Thought in 1939 to be solved by Keller, but Vitushkin found counter-examples in the 1960s ● Hence, mathematical knowledge is only as reliable as human checking is reliable!	
Uncertain, because of difficulties with	**Four Colour Theorem** ● Computers have 'proven' that	**Classification of Finite Simple Groups** ● A proof is spread over 500

verification	any map can be coloured by at most four colours, but the proof could not be checked by humans	journal articles and 10,000 pages, and no single human understands the proof in totality
Uncertain, because its axioms are not necessarily true	**Quantum logic and distributivity** ● For centuries, it seemed to us that fundamental logical principles on which mathematics is built must necessarily be the case. However, we learnt that some principles in classical logic fail to apply in the quantum realm: the law of distributivity was abandoned in quantum logic, creating a different logical system altogether. ● Hence, what seems to us to be logical necessities need not be the case in 'real life', making the truth of even mathematical axioms — founded on these logical principles — open to doubt. If mathematics was built on the principles of quantum logic, some theorems may really not hold!	
Inconsistent	**Russell's Paradox** ● Classical mathematics is ridden with paradoxes: does the set of all sets that do not contain themselves contain itself?	
Incomplete	**Godel's First Incompleteness Theorem** ● Consider the Godel statement G within the system T, that states "G cannot be proven within T" ● If T was a consistent system, G would be true, which means that G cannot be proven within T ● Hence, T would be incomplete if it were consistent ● The implication: if our axioms are unprovable, then our theorems built on those axioms are uncertain as well…	
Undecidable	**Turing's Halting Problem** ● Suppose there is a Turing machine H that can decide if a Turing machine can halt. Put H in a larger Turing machine H+, such that if H decides a machine will halt, H+ doesn't halt, and if H decides a machine will not halt, H+ halts immediately. ● If we ask H to decide if H+ will halt, we run into a paradox: whatever H decides, H+ will do the opposite! Therefore, a machine like H cannot exist. ● Thus, an algorithm that can decide whether a program will halt is undecidable. Many other mathematical problems suffer from the same issue — Wang tiles, the Game of Life etc.	
Irreducible to logic (Frege)	**Zermelo-Fraenkel Set Theory** ● Tried to show that 9 ZF axioms were reducible to logical propositions (i.e. propositions that have complete generality and are true by virtue of its form rather than its content) ○ E.g. Law of the Excluded Middle (i.e. either p or not p is true) ● At least 2 ZF axioms were not reducible, i.e. the Axiom of Infinity and the Axiom of Choice ○ Axiom of Infinity: there exists sets containing an infinite number of elements, true by virtue of its content rather than its form, because of its reliance on the concept of infinity	
Certain, but conditional	**Hyperbolic/Elliptic vs Euclidean Geometry** ● Euclidean geometry is premised on Euclid's parallel postulate: that given a line *l* and a point *P* not on *l*, there exists only one unique line through *P* that is parallel to *l*	

<table>
<tr><td></td><td colspan="2">

Hyperbolic and elliptic geometries originate when this parallel postulate is rejected: there is no unique line in elliptic geometry, and there are two or more distinct lines in hyperbolic geometry
Hence, mathematical knowledge is conditional: it depends on our acceptance of certain axioms. But once we grant those axioms, the knowledge we derive is certain, because the deductive nature of mathematics is truth-preserving.

</td></tr>
<tr><td>Empirical</td><td colspan="2">“1+1≠2”
1+1≠2 if we lived in the subatomic realm where particles often disappear</td></tr>
<tr><td colspan="3">Origins of Mathematical Knowledge</td></tr>
<tr><td rowspan="2">Discovered: Unreasonable Effectiveness (Wigner)</td><td colspan="2">Quine-Putnam’s Indispensability Argument (for Platonism)
We ought to have ontological commitment to all and only the entities that are indispensable to our best scientific theories.
Mathematical entities are indispensable to our best scientific theories.
Therefore, we ought to have ontological commitment to mathematical entities.</td></tr>
<tr><td>Fibonacci Sequences
Fibonacci sequence was used to describe the growth of rabbit populations, but turned up everywhere in nature (e.g. number of petals, seed spirals in a sunflower)</td><td>Riemannian Geometry
Riemannian geometry was first conceived as a puzzle and intellectual exercise
It turned out to have immense practical utility in Einsteinian relativity</td></tr>
<tr><td>Discovered: Independent Discovery</td><td>Calculus
Newton and Leibniz independently discovered calculus</td><td>Pythagorean Triples
Mesopotamia, Egypt and Greece all discovered Pythagorean triples</td></tr>
<tr><td>Constructed: Axiomatic foundations, so it can’t be discovered from nature</td><td colspan="2">Geometry
We don’t build our geometrical systems based on our observations of many rectangles and circles drawn on paper, but rather on logical, theoretical axioms about rectangles and circles.
We therefore cannot say that we discovered properties about circles based on real circles that exist — our new knowledge about circles comes from deductions within our logical system!</td></tr>
<tr><td>Constructed: Divorced from external reality</td><td>Complex Numbers
Complex numbers have no direct relationship with the real world: we can count 3 buns at a restaurant, but we can’t count (1+2i) buns!
Hence, they were a product of human invention: Italian mathematician Bombelli developed the rules of addition, multiplication and root extraction of complex numbers</td><td>Higher Dimensions
We live in a three-dimensional reality, so higher dimensions have no real world correspondence</td></tr>
<tr><td>Constructed:</td><td colspan="2">Quantum logic and distributivity</td></tr>
</table>

Contradicts external reality	● We learnt that some mathematical principles / axioms fail to apply in the quantum realm: the law of distributivity does not apply at quantum scales ● Hence, our mathematical systems cannot possibly be founded on our observations of the world — they don't even accurately reflect the external reality we live in!	
Constructed: Epistemic Argument against Platonism	**Epistemic Argument against Platonism** ● If mathematical entities are abstract entities, they exist outside of space-time. But if humans exist wholly within space-time, how do we make contact with or epistemically access the abstract realm of mathematical entities to study them?	
Constructed: Modelled after the World	**Complex Numbers** ● We invented complex numbers because they're useful for modelling periodic motions (such as water or light waves) as well as alternating currents	**Higher Dimensions** ● Higher-dimensions were conceived and constructed because they have applications in technology like CAT scans
Applications of Mathematical Knowledge		
	Science	**Social Science**
Quantifying Observations	**Specific Heat Capacity** ● With mathematics, we can quantify how much energy is required to raise the temperature of 1kg of water by 1℃ (4.18J), rather than "a fixed amount"	**Consumer Price Index** ● With mathematics, we can quantify exactly how much inflation has been occurring (e.g. with the Consumer Price Index), rather than the general observation that prices have been rising
Modelling for Certain Conclusions	**Epidemiology** ● Given a particular infectivity, reproduction number and population size, we can chart the spread of an epidemic with absolute certainty using a mathematical model	**Price of a Good** ● Given a certain level of demand and supply for a good, economists can predict the price of a good with absolute certainty using a mathematical model
Justificatory Bar in Mathematics		
Certainty, because axioms undergird all of mathematics	**Parallel Postulate** ● If we rejected Euclid's parallel postulate, many geometric results would collapse, as they do in non-Euclidean geometries: ○ The sum of angles in a triangle is 180 ○ Rectangles cannot exist in non-Euclidean geometries	

SCIENCE

Argument	Example(s)

Scientific Method and its Applications	
Scientific Method	**Observation** ● Sparrows' nests are made with grasses rather than twigs.
	Hypothesisation (strong rationale supported by background research, inductive reasoning) ● Based on prior knowledge about the availability of nest building materials (grasses more abundant than twigs) ● Sparrows use grasses in their nests rather than twigs because grasses are the more abundant material in their habit.
	Prediction (Deductive, outcome observed if hypothesis is correct) ● If sparrows use grasses because it is abundant in their habitat, and I were to compare areas with more twigs than grasses available, then in those areas, nests should be made out of twigs.
	Experimentation ● All other variables constant, it is the abundance of building materials that cause the difference in material used for building nests.
	Verification ● Based on the results of the experiment, conclude if "sparrows use grasses in their nests rather than twigs because grasses are the more abundant material in their habit."
Somewhat applicable in the positivist social sciences, because there seem to be laws governing human behaviour	**Law of Demand and Supply** ● It does seem like high demand for a product with low supply is likely to increase the price of the product — when Russia invaded Ukraine and our supply of wheat decreased, the prices of bread rose across the board ● Thus, it does appear that laws governing economic behaviour exist — and if they do, then they can be studied scientifically by observation and experimentation!
Not fully applicable in the positivist social sciences, because of complexity…	**Demand of Goods** ● Demand of goods are influenced by many unquantifiable factors like changing consumer preferences, popular culture etc.
	Abortion and Crime ● 2001 study suggested that legalising abortion in 1973 under Roe v Wade helped to reduce violent crime by 47% in the 1990s
… non-deterministic natures…	**Demand of Goods** ● Since humans (perhaps) have free will, the quantity of ice cream demanded on any given day could vary depending on whether some people *decide* to eat healthily!
… and self-fulfilling prophesies	**Egg Shortage** ● By predicting an impending egg shortage, economists could cause panic buying that actually creates an egg shortage — this happened last year during the pandemic!
Inapplicable in the interpretive social sciences, because of	**"Notes on the Balinese Cockfight"** ● It was not Geertz' ambition to offer any conclusions or predictions regarding cultural practices in general: he just wanted to examine the cultural meaning

the importance of interpretation	embedded in that specific cultural activity at that specific time, in this case, the cockfight in 1970s Balinese culture! ● In this case, experimentation — which wouldn't be able to capture the meaning individuals attributed to the cockfight — seems wholly inappropriate to the knowledge Geertz seeks to construct!
Inapplicable in the study of mathematics, because of its a priori nature	**Pythagoras' Theorem** ● The scientific method tells us about the natural world, but cannot give us a priori knowledge like the Pythagoras' Theorem — we derived that not by 'experimenting' with drawings of different right-angled triangles, but rather by deducing it rationally from theoretical axioms in geometry!
Inapplicable in the study of the past, because of the impossibility of experimentation	**Fall of the Soviet Union** ● The fall of the Soviet Union was caused by a confluence of factors, e.g. glasnost and perestroika, growing climate of people's empowerment, and the stagnation of the Soviet economy ● A historian cannot determine the relative causal significance of each of these factors because history offers no possibility of experimentation / counterfactuals — we cannot create a "control Soviet Union" and remove each of the variables one by one!
Inapplicable in the prescriptive realms, because of Hume's Is-Ought Problem	**Hume's Is-Ought Problem** ● One cannot makes claims about what *ought* to be that are based solely on statements about what *is*: for instance, it would be foolish to conclude that I *ought* to lie, or tell the truth, just by observing that many people lie, or tell the truth ● Therefore, to make normative claims requires some reasoning independent from experience alone: we will never be able to make normative claims just by descriptively observing the world. ● Insofar as science can only describe the world, it cannot justify our normative beliefs.
Aim of Science / Nature of Scientific Progress	
Verification, as it is intuitive.	**Science as rational** ● Theory choice is **objectively** settled by looking at the neutral and objective observable "facts". These facts imply neutrality, and exist out there for us to discover. They are objective, and since <u>theory is dependent on facts</u> (not the other way round), <u>facts are not tainted by theory</u>. ● So the better theory is simply the one which is better supported by evidence. **Science as cumulatively progressive** ● The old theory is replaced by the new, better theory. As our technology improves, our ability to discover "facts" improves. We are getting closer to the Objective Truth - the Theory of Everything!
Not verification, due to the Problem of Induction	**All As are Bs / Principle of Uniformity** General laws become useless under Verificationism since we fail to prove that the law can hold for **all instances.** Science verifies hypotheses by taking a limited number of experiments. It then generalises the observations made with a law of nature applicable at all times and places. This generalisation, or "leap of the mind" inference, is called an induction. However, Scottish philosopher David Hume recognised some problems in the basis

	of justification for induction. This is called the Problem of Induction. While we can gather evidence to support a claim, we cannot verify if the claim is true with absolute certainty. To see the force of the problem, it helps to think about how a scientific generalisation is made. Consider how a scientist wants to verify the generalisation that dominant purple genes dominate white recessive ones. He will have to cross purple and white ones, observing whether purple peas would be the offspring from the limited number of cases. The general idea is to determine whether the generalisation "All As are Bs" is true; we must take many As and see if they are all indeed Bs. Arguing from many instances of As that are Bs to the conclusion that "All As are Bs" is called enumerative induction. If we find an instance in the cross of purple and white peas (A) resulting in purple peas (B), then we can say that the law that "All As are Bs" is upheld for that instance. In other words, laws are supported by their instances. However, the question of **how induction is justified arises**. David Hume postulated the following two lines: I have found, in all past instances, such sensible qualities conjoined with such special powers. So: Similar sensible qualities are always found in every instance with such special powers He claims that the above is not a tautology, where both lines have similar meanings. Indeed, it is not an analytic truth that the lines are equivalent, so the inference is not logically valid. For there are possible worlds where bread provides nourishment in all past instances, but in another, the Earth's intense cosmic radiation killed off all enzymes found in our stomach, so bread no longer provides nourishment. Therefore, Hume's postulated inference is not logical on its own. However, by including a further premise that "The future resembles the past", the inference becomes logically valid. This is called the principle of the uniformity of nature. As such, the new reasoning will look like this, which is much more intuitive: Inductive: In all past instances, bread provides nourishment. The future resembles the past. So: In the future, bread will be nourishing. Even so, Hume reasoned that the problem of induction was that this additional premise was neither a logical truth nor intuitive, so there was no obvious reason to believe it; after all, it is a generalisation. If the only way to justify such a generalisation was to argue in such a similar form, we would have to argue for the principle of the uniformity of nature like this: Inductive: In all past instances, the future resembled the past.

	The future resembles the past. So: The future resembles the past. As we can see, this is a question-begging argument. It already assumes what it set out to prove, i.e. that the future will resemble the past.
Not verification, because the Verification criterion is unverifiable.	**Analytic a priori and synthetic a posteriori** ● Verificationists hold that all meaningful propositions should be either analytic (logically verifiable) or empirically verifiable. ● But the criterion is not logically verifiable, since it is not clear that the subject "meaningful propositions" contain the predicate "analytic or verifiable". ● The criterion is also not empirically verifiable.
Not verification, because its scope is limited.	**Astronomy and Psychology** ● Not all Sciences can use experimentation. For astrobiology, it is not possible. For psychology, it is not ethical.
Not verification, because data is theory-laden, suffers from underdetermination	**Science is not objective, if the goal of Science is verification.** (Content-spam, with link to subjectivity of Science)
Falsification, as it is intuitive.	**Rain dance** ● If a theory could fit any empirical evidence, such that it could prove any outcome, then the theory actually **proves nothing**. ○ Any prediction accommodating all possible outcomes renders the prediction useless. ● Prediction: It will rain if I dance hard enough. Outcome: It doesn't rain. Conclusion: I did not dance hard enough.
Falsification, as it allows us to distinguish between science and pseudoscience.	**Holistic Underdetermination and Marxism, a pseudoscience** ● Falsification distinguishes between pseudoscience and science. Under verificationism, pseudoscience's failure to predict events can be resolved by **ad-hoc explanations**. ● Marxism predicts that capitalism will inevitably give rise to communism. However, we do not consider Marxism as science because it provides ad-hoc explanations - that the inevitable progress to communism had been slowed by the welfare state. ● Under falsificationism, Marxism would not be considered Science as it is not falsifiable.
Not falsification, as it still fails to overcome the Problem of Induction	**How do we conduct Scientific Inquiry? Deductively - conjecturing, then refuting!** ● Popper realised that while we cannot conclusively verify a theory, we can conclusively falsify a theory. ● While we are not absolutely certain that "All As are Bs" because we have observed that all instances of As are Bs and then made an inductive generalisation, we can be absolutely certain that an instance of A not being B will guarantee that the theory is false. ● Popper thus concludes that we conduct Scientific inquiry not by induction, but by conjecturing and then refuting.

<table>
<tr><td></td><td colspan="2">But… how many instances of falsifying results do we need to reject a theory?
An instance of a falsifying result might be due to experimental error. It is impossible to guarantee that the falsifying result is not due to experimental error.
This means that we need more instances of falsifying results to conclusively say that a hypothesis had been falsified.
However, coming up with a number for falsifying results to conclusively falsify a hypothesis will depend on what the scientific community agrees on in the past. For example, the agreed-upon significance level for Science is 0.05, but this value for rejecting a hypothesis only holds true today due to the principle of the uniformity of nature - that the future resembles the past.</td></tr>
<tr><td>Not falsification, as it fails to fit the history of Science</td><td colspan="2">Normal vs revolutionary scientific paradigms
Falsification only applies during the rare instances of scientific revolution, but does not account for normal periods of science.
Historically, scientists tend to explain away falsifying instances with anomalies and experimental error. They tend not to falsify the theory. For example, the discovery of Neptune was not done as a result of falsification. Rather, it was due to an attempt to prove a prevailing theory, Newton’s theory of Universal Gravitation, that Neptune was discovered.
If most theories were rejected upon an encounter of a falsifying result, then little scientific progress can be made. This is counter-intuitive to our idea of scientific progress, especially since scientific progress is widely-accepted. An illustration is the Kardashev classification of civilisation.</td></tr>
<tr><td rowspan="2">Buildup of anomalies leading to a paradigm shift (Kuhn), as it accounts for the history of scientific progress.</td><td colspan="2">Paradigms
During normal paradigms, Kuhn argues that the scientific community shares the same outlook, holding the same accepted and fundamental theoretical assumptions, and in that period have “exemplars” - problems solved by existing theories - and gaps but with clues as to where to find the answers.
This paradigm seems to be well accounted by well-known examples like Mendelev’s periodic table. He arranged the elements in groups according to weights and properties, leaving gaps where he expected an element and predicting its properties.
When Gallium, Germanium and Strontium were discovered, their weights and properties were predicted. The periodic table told scientists where to look and how to classify what they found.
Scientists do not try to falsify theories during normal periods. It is only when there is a large accumulation of falsifying results and anomalies that scientific revolution occurs - the rejection of previous theories.</td></tr>
<tr><td>Newton to Einstein
The observation that there was no difference in the speed of light from stationary and moving sources challenged fundamental assumptions in Newtonian mechanics, prompting a leap to Einstein’s paradigm of relativity</td><td>Divine Creation vs Evolution
The discovery of fossils with no correspondence to existing species challenged theories that all species were divinely created by God, perfectly suited to their environments</td></tr>
<tr><td colspan="3">Problems with Scientific Inquiry through the Scientific Method</td></tr>
<tr><td>Observational Error by Scientists</td><td colspan="2">Expert Seeing
Scientists use scientific equipment like telescopes and microscopes to make</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">observations, who then deem them better than the “naked eye”.
● But only experts are trained in them, which means that us laymen cannot verify or falsify any claims made with the use of scientific equipment.
● Scientists could be wrong, and they have been in the past!
● See Theory Ladenness of Observation, Galileo’s inaccurate moon drawings due to his crude telescope.
● Hence, scientific observations are not certain. We cannot trust Science!</td></tr>
<tr><td rowspan="2">Theory Ladenness of Observation (Perceptual)</td><td colspan="2">Expectations
● Our observations can be influenced by our background beliefs of what we observe, leading to us seeing what we expect to see. Our observations become theory-laden, which means they are no longer objective or theory-neutral.</td></tr>
<tr><td>Mercury and Vulcan
● When Mercury was found to be deviating from its orbit according to Newton’s laws, scientists suggested that it was due to an undiscovered planet Vulcan. They were so convinced that they even saw it in their telescopes!
● After all, using a planet to explain deviations in orbit was successful in the discovery of Neptune. Uranus' orbit was also deviating from its orbit then.
● However, it was later discovered that Mercury’s orbit deviation could be explained by Einstein’s Theory of Relativity.</td><td>Little Sperm Men
● When sperm was first observed under a microscope, researchers claimed to have seen sperm in the shape of little men
● This shows how their perceptual experiences were heavily shaped by their existing theoretical assumptions of preformationism — that a human existed in miniature before enlarging in size!</td></tr>
<tr><td>Theory Ladenness of Experimentation (Salience)</td><td colspan="2">Lightning and Thunder
● During the data-gathering stage, scientists have to determine which one(s) of the infinite number of variables to observe at any given time is relevant. Need to determine relevance due to:
○ Science requires experimentation, in turn requiring the selection and study of certain variables.
○ Physically impossible to study all variables at any given time.
● A scientist in ancient Greece — where lightning and thunder were considered to be caused by the wrath of the gods — would have experimented on lightning and thunder very differently from a modern scientist, where lightning and thunder are treated as products of meteorological processes
● The ancient Greek scientist would likely experiment to see which sins would incur Zeus’ wrath and produce thunder and lightning, while the modern scientist would be conducting measurements of atmospheric pressure, cloud height etc.
● Evidently, the variables each scientist decides as relevant differ across time, culture, and pre-existing scientific knowledge.
● This selection of relevant variables undermines the objectivity of Science.</td></tr>
<tr><td>Observer Effect</td><td colspan="2">Quantum Physics</td></tr>
</table>

	● The act of observing affects the observed reality. ● When there is an observer, electrons are observed to behave in particles. When there is no observer, electrons behave like waves. ● The possibility of contradictions in observations leads to uncertainty in Science.
Confirmation Bias	**Little Sperm Men** ● Scientists tend to look for observations that verify their hypothesis. This subjective process makes Science subjective. ● When sperm was first observed under a microscope, researchers claimed to have seen sperm in the shape of little men ● This shows how their perceptual experiences were heavily shaped by their existing theoretical assumptions of preformationism — that a human existed in miniature before enlarging in size!
Underdetermination	Where a theory is not accounted for by evidence sufficiently to guarantee the theory's proof or **certainty**. (Graph illustration) Contrastive underdetermination - Choosing one theory over the other in the face of confirming results, where evidence fit multiple theories. Holistic underdetermination - Choosing to jettison a theory or add a rejoinder to that theory in the face of falsifying evidence. Problem: Evidence should be the **objective arbiter** for theory choice. But underdetermination shows that that is impossible.
	Contrastive Underdetermination ● When selecting a theory over another, scientists appeal to criteria. These include simplicity, fecundity, comprehensiveness, predictive power, etc. However, scientists have to make the **subjective** decision on which criteria are privileged over the other, making theory choice a subjective process. Science cannot be trusted! **Newton's Laws of Motion and Gravitational Attraction** ● Newton realised that the same predictions are made whether he assumed that the universe was at rest or was moving at some constant velocity in any given direction. ● Both assumptions are mutually exclusive, so a **subjective choice** between the assumptions for Newton's theory of gravitation had to be made. ● Both assumptions result in the same empirical predictions, so no evidence can permit Newton to decide which assumption to use on empirical grounds.
	Holistic Underdetermination ● It is impossible to test a hypothesis in isolation, without any assumptions of other hypotheses which inform the scientist's test. ● Scientists derive empirical consequences from an hypothesis *only* when it is *conjoined* with many other beliefs of the world, such as how instruments operate and other hypotheses of how objects in the scientist's original field of study affects the surrounding environment, etc. ● So when an empirical prediction turns out to be **falsified**, scientists will have to make a decision. They can either count the falsifying result as an anomaly (the fault rested in the scientist's experimental error) or with one of

	the many background assumptions used to generate the failed prediction. ● The process of choosing to make ad-hoc amendments to their hypothesis, or their experimental method, or even the entire scientific paradigm they are in (like giving up the theory fundamental to much of science then - like the aether or phlogiston theory), is a **subjective** choice. Thus, evidence is not an arbiter of theory choice. **Mercury and Vulcan** ● Uranus was found to be <u>consistently</u> deviating from its orbit according to Newton's gravitational theory. By Popper's falsification, Newton's theory ought to be jettisoned. ● However, Adam and Leverrier questioned an assumption instead of rejecting the theory whole. They posited that there was an eighth planet, Neptune, thereby generating an ad-hoc hypothesis to save Newton's theory. ● By Newton's theory, they were able to calculate the position of the supposed eighth planet, and found Neptune. ● The issue then was that Mercury's deviation in orbit could not be explained by an ad-hoc hypothesis of another planet Vulcan, for it could not be found. Newton's theory was jettisoned, and Einstein's theory of relativity was found to make more accurate empirical predictions. ● When do we know whether we should generate an ad-hoc hypothesis, or jettison a theory? This process seems dependent on scientists' conservatism towards scientific theories, which makes scientific theories **subjective**.
Unverifiability, due to the Problem of Induction	**All As are Bs / Principle of Uniformity** Science verifies hypotheses by taking a limited number of experiments. It then generalises the observations made with a law of nature applicable at all times and places. This generalisation, or "leap of the mind" inference, is called an induction. However, Scottish philosopher David Hume recognised some problems in the basis of justification for induction. This is called the Problem of Induction. While we can gather evidence to support a claim, we cannot verify if the claim is true with absolute certainty. To see the force of the problem, it helps to think about how a scientific generalisation is made. Consider how a scientist wants to verify the generalisation that dominant purple genes dominate white recessive ones. He will have to cross purple and white ones, observing whether purple peas would be the offspring from the limited number of cases. The general idea is to determine whether the generalisation "All As are Bs" is true; we must take many As and see if they are all indeed Bs. <u>Arguing from many instances of As that are Bs to the conclusion that "All As are Bs" is called enumerative induction.</u> If we find an instance in the cross of purple and white peas (A) resulting in purple peas (B), then we can say that the law that "All As are Bs" is upheld for that instance. In other words, laws are supported by their instances. However, the question of **<u>how induction is justified arises</u>**. David Hume postulated the following two lines:

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So: Similar sensible qualities are always found in every instance with such special powers

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However, by including a further premise that "The future resembles the past", the inference becomes logically valid. This is called the principle of the uniformity of nature. As such, the new reasoning will look like this, which is much more intuitive:

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Even so, Hume reasoned that the problem of induction was that this additional premise was neither a logical truth nor intuitive, so there was no obvious reason to believe it; after all, it is a generalisation. If the only way to justify such a generalisation was to argue in such a similar form, we would have to argue for the principle of the uniformity of nature like this:

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<tr><td>Problems with peer review</td><td colspan="2">MMR Vaccine
● Andrew Wakefield's fraudulent paper linking the MMR vaccine to autism and developmental disorders was published in The Lancet, slipping past peer-review mechanisms</td></tr>
<tr><td rowspan="2">If Science is the buildup of anomalies leading to a paradigm shift (Kuhn), then the subjective nature of choosing a theory makes science look irrational.</td><td colspan="2">A theory can never be conclusively falsified or verified.</td></tr>
<tr><td>Contrastive Underdetermination
● We can never know which paradigm to choose objectively, for we inevitably have to make the subjective choice of which criteria is privileged over another in paradigm-choice.</td><td>Holistic Underdetermination
● We can never objectively make a choice of whether to jettison a paradigm or retain the existing paradigm.
● How much anomalies is considered a sufficiently large</td></tr>
</table>

		buildup of anomalies for a paradigm shift?
	During periods of normal science: Theory-Ladenness of Data ● Perception theory-ladenness: a scientist makes observations through the lens of an existing paradigm / set of theories; he is not really observing things objectively or neutrally. ● In other words, his data is already theory-laden as perception is heavily conditioned by background beliefs, ○ Scientists seeing men with beards in sperm ● Semantic theory-ladenness: reports are couched in highly theoretical language such that one's theory is already privileged ○ "an electric current is flowing through the copper rod" contains a lot of theory about electricity that would not be accepted by a scientist who does not hold standard beliefs about electricity. ● Salience theory-ladenness: where one's theory determines which variables are relevant (i.e. salient) and should be observed and which aren't Thus, scientists cannot divorce theory and their observations completely, meaning that objectivity in science is compromised.	
	During paradigm-shifts: Incommensurability of Language ● There are instances where language between different scientific paradigms are incompatible with each other - the same scientific term might mean different things in different paradigms. ● For example, mass in Newtonian and Einsteinian mechanics differ in meaning. For Newton, mass is conserved but for Einstein, mass is convertible with energy. Only at low velocities do they mean the same way, and even then they must not be conceived as the same. ● So it becomes difficult for scientists to choose another theory if communication between scientists of each paradigm is very difficult.	
	During paradigm-shifts: Incommensurability of standards ● Proponents of different paradigms might disagree about the standards in evaluating paradigms. The standards in evaluating a "good paradigm", like how well it can account for problems in the previous paradigm or which problems it should solve in the first place, is already tainted by the previous paradigm. ● For example, in the 17th Century, many did not accept Newton's account of gravitation, involving action at a distance without any underlying explanation. Instead, that paradigm accepted Descartes' vortice explanation, or Ptolemy's explanation of the motion of planets by contiguous crystalline spheres. ● It was only when a paradigm-shift occurred, where scientists started to accept the concept of a fundamental force without underlying explanation, did Newton's law of gravitation gain traction. Indeed, in Newton's case, the very similarity between Coulomb's law of electrostatic attraction to Newton's law of gravitation led to the acceptance of Newton's theory. ● Therefore, it is very difficult for scientists to divorce themselves from the paradigm they live in, and take on an objective external, "God-like" view of	

	paradigms, and evaluate paradigms without having paradigm-standards subjectively clouded by their own paradigm.	
Reasons to Trust Science (Ways to mitigate bias and uncertainty in Science)		
Increase objectivity through measurability of variables.	**Precision and objectivity (non-biasedness)** ● Counting the instances of things falling to the ground when let go of from a height	
Variables measured through Scientific Instruments	**Colorimeter** ● We can use colorimeters to measure the specific wavelengths of light reflected, minimising the potential for subjective judgments / the ambiguities of language	
Increase certainty through controllability of variables.	**Effect of shape on falling object's speed** ● Should be able to vary only one factor at a time to determine its effect ● Changing the objects being dropped while keeping the environment constant, or testing a range of environments with a standardised set of objects	
Increase objectivity through ensuring repeatability of results: Falsification through peer review	**Blondlot's N-rays** ● Blondlot's N-rays were quickly debunked after results could not be replicated	**Cold Fusion** ● Fleischmann and Pons' claims to have discovered cold fusion were quickly debunked after replications were withdrawn and experimental error was discovered
Falsification through the introduction of new evidence	**Phlogiston** ● Phologiston theory of combustion was disproven after the mass of some metals (e.g. magnesium) was shown to increase after burning	
Increase objectivity by mitigating underdetermination with Occam's Razor	**Einstein vs Lorentz** ● We can resolve underdetermination by using the principle of parsimony: we often opt for theories and explanations that involve the smallest set of elements ● For instance, Einstein's theory of relativity was accepted over Lorentz's competing explanation because his postulated the existence of an "aether", or unobservable fabric of space, which served as the prime frame of reference. Lorentz's use of aether is unintuitive! ● Objection: The use of parsimony as a criteria for theory choice is itself a **subjective** choice, <u>privileging simplicity as a criteria</u> over other criteria like fecundity (ability to give rise to other theories), predictive power.	
Predictive power remains	**Newtonian Mechanics** ● Newtonian mechanics remains relevant even though Einsteinian relativity has replaced it, because it remains highly accurate at low speeds, giving it sufficient predictive power	**Atomic Models** ● Even though electrons exist in probability clouds rather than the fixed orbits of Bohr's model of the atom, much of chemistry remains relevant because it can still predict reactions that will take place
Wrong theories aid	**Maxwell's Theory of Electromagnetism**	

discovery	● Maxwell's theory that electromagnetic waves are vibrations of an aether was false, but it helped scientists discover radio waves
Justificatory Bar in Science	
Not certainty, because we just need sufficient accuracy and predictive power	**Newtonian Mechanics** ● Newtonian mechanics remains relevant even though it does not account for relativistic effects, because it remains highly accurate at low speeds, giving it sufficient predictive power for basic calculations like a car's velocity and momentum for an engineer designing a road
But sufficiently high, because science has numerous practical and technological applications	**Lysenkoism** ● Lysenko's rejection of Mendelian genetics in favour of the belief that organisms could pass on traits acquired through use or disuse in their lifetimes informed much of Soviet agriculture, creating famines that killed millions

SOCIAL SCIENCES

Argument	Example(s)	
Strengths of Positivist Social Science		
Precision	**Economic Forecasts** ● Statistical analyses and economic models have enabled precise economic forecasts, involving the prediction of the extent and duration of a recession ○ Economic forecasts for the year are generally accurate by May!	
Accurate. Quantifiable Confidence Level	**Statistical Tools** ● p and r^2 values are often used to indicate the strength of a correlation, and statistical models can give us error margins based on the sample size ● This enables researchers to quantify the strength of their predictions!	
Isolate Variables	**Multivariate Regression Analysis** ● Models can employ multivariate regression to simultaneously evaluate the impact of multiple independent factors on a dependent factor ● For instance, a supermarket can simultaneously study the impact of temperature, gas price and the day of the week on demand for goods	
Ostensibly able to generate laws governing human behaviour	**Law of Demand and Supply** ● It does seem like high demand for a product with low supply is likely to increase the price of the product — when Russia invaded Ukraine and our supply of wheat decreased, the prices of bread rose across the board ● Thus, it does appear that laws governing economic behaviour exist, and are produced by positivist methodologies of economic models, etc.!	
Limitations of Positivist Social Science		
Researcher Selection	**Scoring a Post-Test** ● Scoring a post-test requires the researcher to select what topics and skills to test, what options to	**Components of CPI** ● Inflation can be distilled to the Consumer Price Index, but the researcher must determine what

	put, as well as how to weigh each of the questions	goods and services to include in that index
Order Bias (Questioning)	**Communist Reporters** ● 1950 study found that Americans were more likely to support letting communist reporters into a country if the question was preceded by a question on whether communist countries should let American reporters in	
Phrasing	**"Terrorist vs Shooter"** ● Oxford study found that public perceptions of an attacker were far more negative when he is labelled a "terrorist" rather than a "shooter"	
Subjectivity	**Likert Scales** ● A 5 on the Likert scale for me is different from a 5 for you ● Even if descriptors are added, e.g. "5 being ecstatic", my understanding of "ecstatic" might still differ from your understanding of "ecstatic" — I might need to have won the lottery to be ecstatic, whereas you might have needed a good meal!	
Hawthorne Effect	**Hawthorne Works** ● When researchers were studying productivity at Hawthorne Works in 1930, they found that almost any change to any independent variable (e.g. making lights dimmer) led to a rise in productivity ● Later analyses showed that it was their presence that generated the increase in productivity	**Handwashing in Toilets** ● Far more toilet users washed their hands when a researcher was there observing
Predictions Affect Outcome	**Egg Shortage** ● By predicting an impending egg shortage, economists could cause panic buying that actually creates an egg shortage — this happened last year during the pandemic!	**Inflation** ● By predicting rising inflation, economists could prompt governments to increase interest rates to curb inflation, negating their own prophesies
Inability to Quantify	**Happiness** ● World Happiness Index measures proxies such as life expectancy, GDP per capita, level of social support etc, but it does not account for the specific factors that influence your happiness, e.g. sleep, quality of relationships…	
Inability to Isolate Variables	**Academic Achievement** ● A study on pedagogical tools to improve academic achievement cannot ensure that all students have the same socio-economic background and family environment, which could all impact academic performance	**Economic Performance** ● A study on whether higher taxes in Singapore would improve GDP growth cannot create a "control Singapore" with all other variables constant!
Limitations: Differences from Science		

	Science	Social Science
Greater Complexity	**Rate of Evaporation** ● Determined by a few variables only: wind, temperature, surface area	**Demand of Goods** ● Demand of goods are influenced by many unquantifiable factors like changing consumer preferences, popular culture etc.
		Abortion and Crime ● 2001 study suggested that legalising abortion in 1973 under Roe v Wade helped to reduce violent crime by 47% in the 1990s
Non-Deterministic (Non-Causal)	**V=IR** ● Given a particular current and resistance, we can immediately determine voltage	**Demand of Goods** ● Since humans (perhaps) have free will, the quantity of ice cream demanded on any given day could vary depending on whether some people *decide* to eat healthily!
Self-fulfilling prophecies	**V=IR** ● Predicting the voltage doesn't change the voltage!	**Egg Shortage** ● By predicting an impending egg shortage, economists could cause panic buying that actually creates an egg shortage — this happened last year during the pandemic!
Justificatory Bar in Positivist Social Science		
Not certainty, because social science does not need and cannot achieve the same level of precision and predictive power	**Demand of Goods** ● Given that demand is influenced by many factors (e.g. changing consumer preferences, irrational or emotional whims) and the free will of consumers, we will never be able to predict with certainty the exact quantity demanded on every day — no economist makes this promise, because social science is ultimately a complex, multicausal and non-deterministic field of study grounded in human behaviour! ● Hence, we accept that social science can merely be used to guide our decisions: a demand model is used as a guide for a shop seeking to determine roughly how much ice cream to make on a particular day, rather than a prediction machine seeking to determine the exact fluctuations in ice cream sales!	
Limitations of Interpretive Social Science		
Hawthorne Effect	**Lesson Observations** ● US study: lesson observations lead to pupils above Grade 9 paying more attention, affecting the observer's ability to determine if the pedagogical technique employed is really effective	
Limited Temporal Scope	**Peach Emoji** ● Originally meant to refer to the fruit, the emoji later referred to someone's	

	posterior and then Trump's impeachment! ● Hence, observations drawn from interpretive social science are highly limited temporally	
Limited Cultural Scope	**"Notes on the Balinese Cockfight"** ● Geertz' 1973 seminal paper can give us knowledge of one cultural practice in one culture, but cannot offer any conclusions beyond that	**"Coming of Age in Samoa"** ● Anthropologist Margaret Mead lived with a group of Samoa girls for a period of time, interacting with them to understand their struggles during adolescence ● But her conclusions are only applicable to Samoa in the 1920s…
Justificatory Bar in Interpretive Social Science		
Not certainty, because it just seeks to understand the meaning that individuals attribute to their actions	**"Notes on the Balinese Cockfight"** ● Interpretivists recognise and acknowledge that meaning differs between cultures across time! ● It was not Geertz' ambition to offer any conclusions regarding cultural practices in general: he just wanted to examine the cultural meaning embedded in that specific cultural activity at that specific time	
Critical Social Science		
Self-fulfilling / Catalysing Change	**Communist Manifesto and the 1917 Revolution** ● Marx's observations about class conflict and the exploitation of the proletariat was a catalyst for the 1917 Revolution in Russia ● Of course, this makes the accuracy of critical social scientific claims hard to verify: predictions of class conflict actually created class conflict!	

HISTORY

Argument	Example(s)
Problems with Historical Inquiry	
From "grand narratives" to "petit recits" — Lyotard	
Victor's History	**Allied War Rape during WWII** ● Heavy Allied focus on German atrocities (e.g. Holocaust) and Japanese atrocities (e.g. the Rape of Nanking) ● But the Allies often concealed accounts of their own crimes: wartime files that documented how American GIs committed more than 400 war rapes in Europe were concealed until 2006
Selectivity	**Cuban Missile Crisis** ● Different accounts of the Cuban Missile Crisis pin the blame variously on Kennedy, Khrushchev and Castro ● The historian inevitably has to select between these sources to present a coherent account of the crisis

Ideological Bias	**Origins of the Cold War** ● An American historian growing up in the Cold War may subconsciously select more Western government accounts that cohere with what he was taught in school and therefore appear more reliable ● As such, he might attribute more responsibility for the start of the Cold War to the expansionist tendencies of the Soviet Union, as this is the predominant narrative found in Western government accounts	
Shaped by Goal	**Carr's Fish Illustration** ● Just as a fisherman picks different fishing spots and lures based on what fish he seeks to catch, a historian searches for sources differently depending on what argument he seeks to make	**Caesar's Clothes** ● What Caesar wore when he rode into Rome celebrating his quadruple victory in 46 BCE would be of little relevance to a historian studying the military history of Rome, but of great importance to a historian studying the fashion history of Rome
Imposition of Modern Concepts	**Ramses II Marrying his Daughters** ● Ramses incestuously married no less than four of his daughters, but that was because marriage was fundamentally different in Ancient Egypt: rather than a romantic or sexual companionship, it was an ancient pharaonic tradition that allowed daughters of pharoahs to assume higher status	
Emplotment (White) / Picking Start and End	**Singapore's History** ● A historian that tells Singapore's history from its days as a flourishing entrepot under the British to its occupation by the Japanese would present Singapore as a city tragically destroyed by war ● However, another historian that tells Singapore's history from its devastated state after WWII to a flourishing first-world city state presently would present Singapore as a miraculous success story	
Subjectivity in Language	**"Invasion" vs "Military Operation"** ● Russian accounts of the war in Ukraine neutrally call it a "special military operation", while Western accounts condemn it as an outright "invasion" ● Hence, the language that the historian employs is loaded with connotations and associations that create subjectivity	
Inability to isolate variables through experimentation	**Fall of the Soviet Union** ● The fall of the Soviet Union was caused by a confluence of factors, e.g. glasnost and perestroika, growing climate of people's empowerment, and the stagnation of the Soviet economy ● A historian cannot determine the relative causal significance of each of these factors because history offers no possibility of experimentation / counterfactuals — we cannot create a "control Soviet Union" and remove each of the variables one by one!	
Predictions Cannot Account for Chance	**Trotsky's Illness** ● Stalin's ascension to power was in part caused by Trotsky's sudden illness and consequent failure to attend his party's plenum, a chance event no historian could have predicted	
Historical Prophecies	**Francis Fukuyama's "End to History"**	**Industrial Revolution and**

are Wrong	● Francis Fukuyama famously predicted that the end of the Cold War would bring an end to major ideological conflict, but he was proven wrong with the War on Terror in the 2000s	**Unemployment** ● The Industrial Revolution led many to predict that mass unemployment would result, but such fears did not materialise
Lack of a Temporal "Resting Place"	**History of Social Movements** ● A historian is always situated in a moment in time — given that he is never able to step out of time to view the future, he is inevitably presented with an incomplete picture of human history ● A historian writing about social movements in the mid 20th century would not be able to refine his observations based on the colour revolutions of the late 1980s and the Arab Spring in 2011, as he is confined to his understanding of social movements before then	
Reasons to Trust History		
"veto power of the sources" — Koselleck		
Bound by sources and evidence (Koselleck)	**Holocaust Denial** ● Historians cannot deny that the Holocaust existed, because this would fly in the face of overwhelming evidence (e.g. survivors' accounts, photographs of concentration camps) to the contrary	
Examination of the Historian (Carr)	**Sima Qian** ● Sima Qian's accounts of history (The Book of Han) had to conform to the diktats of the Han court, and thus his accounts are no longer treated as reliable sources of historical evidence	**Tiananmen Square Massacre** ○ Chinese historians omit mention of the Tiananmen Square massacre, but we know to discredit these accounts — this is because we recognise that CCP censorship laws mean that these historians would be arrested should they discuss the massacre
Intersubjectivity / Cross-Referencing	**Operation Rolling Thunder** ● Given that both North Vietnamese and American sources acknowledge that Operation Rolling Thunder failed to weaken North Vietnamese resolve, even though they have competing interests, we can be fairly certain that Operation Rolling Thunder was a failure	
Introduction of New Evidence	**History of Social Movements** ● As history unfolds, the historian has access to more events with which to refine his observations — while a historian writing in the 19th century might only be able to make predictions from the French Revolution, a historian writing about social movements today could draw from events like the colour revolutions in the late 1980s and the 2011 Arab Spring	
Historical debates	**Soviet role in the Japanese surrender** ● Because of the inherently multicausal nature of history, every historical event can be attributed to a confluence of unique historical factors that	

	eventually catalysed the outcome. ● It is the process of historical debate that helps us identify these new causal factors and incorporate them into our understanding of the past: revisionists, by contesting the traditional account that the atomic bombs singlehandedly ended WWII, have drawn our attention to Soviet accounts that point to an impending Soviet land invasion that would have influenced Japan's decision to surrender.
Justificatory Bar in History	
Not certainty, because history does not need and cannot achieve the same precision or predictive power (as science)	**Mackinder Conflict over the "Heartland" / Thucydides Trap** ● Given that history is ultimately a complex, multicausal and non-deterministic field of study grounded in human behaviour and chance, no historian promises to make highly precise and accurate predictions: Mackinder's prophecy that European conflict would erupt over control of the Heartland did not need to predict the specific rise of Hitler or the specific military operations of WWII ● Rather, he simply needed to offer an understanding of what might happen in the early 20th century, which his prophecy did achieve!
Not objectivity, because we need subjectivity to imbue history with meaning / to learn from history	**Rise of Hitler** ● Even if we could objectively discover all the facts relating to Hitler's rise and list objectively all the reasons for his rise to power, this would be of little value to us: it would be a meaningless compilation of facts that do not fit into a 'coherent' narrative that 'makes sense' to us. Hence, history will have failed in its desiderata of helping us understand the past and learn from it! ● By attributing Hitler's rise to power to the popular appeal of his fascist ideology, even if it neglects other causes like Jewish economic privilege or the role of propaganda, it tells us a far more useful insight into our past that we can learn from: that we need to purge such noxious ideologies from civil discourse!
Not total subjectivity, because we need some objectivity to learn from history	**Tiananmen Square Massacre** ● We can't have history that is totally divorced from the facts — if you deny that the Tiananmen Square massacre happened and write a totally different account of the events of June 4, 1989, that will not only fail to help us learn from history, but it would also have dangerous, unethical ramifications, for instance failing to hold those who perpetrated the massacre to account!

ETHICS

Argument	Example(s)
Nature of Moral Statements / Moral Semantics	
Truth-apt	**Frege-Geach Problem** ● We often express moral judgments using the semantic terms and structures associated with propositional content ○ For instance, we say "if torture is wrong, then getting your brother to torture the cat is wrong". In this case, we used ordinary logic operators ("if… then") and the structure of a conditional. ● However, if moral statements were not truth-apt…

	○ P1: Torture is wrong ○ P2: If torture is wrong, then getting your brother to torture the cat is wrong. ○ C: Therefore, getting your brother to torture the cat is wrong. ○ P1 is an expression of an attitude, P2 does not express an attitude. Since P1 =/= P2 lest equivocation, non-cognitivists have to contend with equivocation! Fallacious. So P1 must not be an attitude/expression.
Emotive (Ayer), because this explains the underlying motivation of moral statements **Non-Cognitivist**	**"Killing is wrong" = "Boo to killing"** ● When we express that something is immoral, this often comes with an underlying motivation ○ We are often emotionally repulsed by that particular act: we say that "killing is wrong" because we are alarmed by that act ● In this way, moral statements function like expressions of emotions
Imperative (Hare), because this explains the perlocutionary force of moral statements **Non-Cognitivist**	**"Lying is wrong" = "Don't lie"** ● When we express that something is immoral, it is bundled together with an perlocutionary act ○ Moral statements induce the person committing that act to stop: by telling our children that "lying is wrong", we stop them from lying in the future ● In this way, our moral statements function like imperatives
Not necessarily emotive or imperative, because there are other ways to account for the motivations and perlocutionary force **Cognitivist**	**"It is going to rain"** ● When we say "it is going to rain", it could still be motivated by some kind of emotion (e.g. fear that one will get wet when one leaves the house), and it can also be accompanied by a perlocutionary act (e.g. it induces one to bring an umbrella) ● However, this does not mean that the statement itself ("it is going to rain") is not propositional in nature!
Nature of Moral Judgments / Moral Ontology	
Subjective and relative, because we disagree on moral issues	**Abortion, animal testing, physician-assisted suicide, gene editing…** ● We disagree on the moral status of a whole host of controversial issues, such as abortion, animal testing, physician-assisted suicide, gene editing etc. ● This ostensibly suggests that morality is subjective and relative to cultures, individuals or societies!
Subjective and relative, because culture affects how we rank moral principles	**Honour killings** ● In the Middle East and North Africa, some communities accord greater moral importance to the dignity of the family than to the life of the individual who has committed a dishonourable act. As such, it is seen as morally acceptable or even necessary to murder the individual who has brought shame to the family, even though this is an immoral act by Western conceptions of morality ● In this way, cultures lead us to prioritise different moral principles, leading to subjectivity and relativity in moral knowledge

Intersubjective and somewhat universal, because there is consensus on some moral issues	**Universal Declaration of Human Rights** ● Even though there are contentious moral issues (e.g. abortion), there is also wide-ranging consensus on many other uncontroversial moral questions ● For instance, many of the rights listed in the Universal Declaration of Human Rights are incontrovertible: few would disagree that we have a right to life, freedom from torture and self-defence.
Universal, because relativism encounters a logical contradiction	**Paradox of relativism** ● Moral relativism seems to espouse tolerance of diversity of values — yet tolerance itself is a value, and as such moral relativism (like all forms of relativism) seems to contain a contradiction, requiring something (relativism) to be absolutely held.
Universal, because we try to convince one another	**"Strawberry is the tastiest ice cream flavour"** ● If morality was truly relative, we would not engage in so much debate about what individuals should or should not do: in the same way that we do not argue about whether "strawberry is the tastiest ice cream flavour" because we recognise that this is a matter of subjective personal preference, we would not argue about whether abortion is moral if it was also up to the individual / community to decide ● The fact that we still engage in heated debate over these moral issues reveals our underlying universalist conviction: that moral facts exist and should apply to everyone!
Universal, because moral discourse is built on common assumptions	**Kant's universalisability and free will** ● Kant does a great job at identifying common, rational assumptions on which all coherent moral systems must be built. ● Kant identifies that morality stems naturally from free will, and this is a claim hard to dispute. This is because our moral discourse assumes free will exists — if our actions were to be fully predetermined, moral discourse would certainly be useless! We also would not praise or punish people for moral or immoral acts — they had no agency, after all. --- ● Kant, for instance, offers a formulation of the Categorical Imperative in the form of universalisability: this is necessary and rather indubitable, because a moral law which prescribes its own collapse would encounter a logical contradiction!
Value plural, because we can 'regret' the moral choice	**Trolley Problem** ● Subjectivity is introduced into moral knowledge when we choose to prioritise different ethical scales: in the Trolley Problem, individuals could subjectively choose to prioritise the deontological duty not to take life and not pull the lever, or prioritise the utilitarian consideration of maximising happiness and pull the lever ○ This explains why we can 'regret the moral choice' — we can pull the lever, and yet regret that we had to take life! This would be bizarre under value monism — how can we regret choosing more of the only kind of value? ● However, these ethical scales of value (e.g. utilitarianism, deontology) are still universal, and subjectivity is only confined to the instances where they disagree!
Subjective only because we have not	**Nagel's attempts to reconcile deolontology and consequentialism** ● Morality might involve subjective prioritisations of one ethical scale over

figured out how to choose between different scales of value	another, but this could simply be because we haven't found the perfect, all-encompassing moral standard that accounts for all moral facts without any flaws or contradictions! ● For instance, deontology and consequentialism could issue contradictory imperatives only because we haven't figured out which ethical theory applies in which situation, a problem which philosophers like Nagel are trying to solve. It could be that once we have found a fully comprehensive moral system that eliminates these contradictions, such subjectivity could disappear.
Reducible to natural properties	**Deontology, utilitarianism, virtue ethics…** ● Much of modern the modern ethical enterprise has sought to distil moral properties into natural ones ○ Deontology associates moral goodness with duty ○ Utilitarianism associates moral goodness with pleasure, happiness and the like ○ Virtue ethics distils moral goodness into virtues, such as courage, integrity and the like
Irreducible to natural properties	**Moore's Open Question** ● If moral goodness were really analytically equivalent to a natural property (e.g. duty), the question "I know X is dutiful, but is it good?" would be a tautological, foolish question in the same way that "I know X is a bachelor, but is he unmarried?" is a tautological, foolish question ● But intuitively, we don't think that question is foolish in that way! Therefore, duty (or any other natural property) cannot be analytically equivalent to moral goodness, and moral goodness cannot be distilled to a natural property
Nature of Moral Knowledge / Moral Epistemology	
Not from religion, because of the Euthyphro Dilemma	**"Is the pious loved by the gods because it is pious, or is it pious because it is loved by the gods?"** ● In essence, proponents of divine command theory need to solve a 'chicken-and-egg problem': does morality undergird God's command, or does God's command undergird morality? ● If the former, then God seems to be irrelevant to the nature of morality — it seems that being commanded by God is not the nature of that which is moral, merely a quality. ● If the latter, then morality becomes totally arbitrary: God could conceivably change his commands tomorrow, and morality would change as well. This arbitrariness fails to account for the normative element of morality: why should we follow moral laws if there are no reasons for those laws?
Ostensibly from experience	**Asian prioritisation of filial piety** ● An Asian child, living in a community where moral virtues of filial piety are preached and practised frequently, is more likely to grow up believing in the moral importance of filial piety, whereas a Western child, living in a community where individualism is emphasised, is likely to place less moral weight on filial piety ● This would only be the case if we acquired moral knowledge from our experiences and observations of the world: their similar faculties of reason and intuition would not produce these differences!

Not from experience, because moral properties are irreducible to natural properties	**Moore's Open Question** ● If moral goodness were really analytically equivalent to a natural property (e.g. duty), the question "I know X is dutiful, but is it good?" would be a tautological, foolish question in the same way that "I know X is a bachelor, but is he unmarried?" is a tautological, foolish question ● But intuitively, we don't think that question is foolish in that way! Therefore, duty (or any other natural property) cannot be analytically equivalent to moral goodness, and moral goodness cannot be distilled to a natural property
Not from experience, because of Hume's Is-Ought Problem	**Hume's Is-Ought Problem** ● One cannot makes claims about what *ought* to be that are based solely on statements about what *is*: for instance, it would be foolish to conclude that I *ought* to lie, or tell the truth, just by observing that many people lie, or tell the truth ● Therefore, to make normative claims requires some reasoning independent from experience alone: we will never be able to make normative claims just by descriptively observing the world.
Not from experience, because it leads to relativism…	**Abortion, animal testing, physician-assisted suicide, gene editing…** ● We disagree on the moral status of a whole host of controversial issues, such as abortion, animal testing, physician-assisted suicide, gene editing etc. ● How would we decide — based on observing this myriad of contradictory moral positions — which position is 'objectively' correct?
… and we don't want relativism, because we try to convince one another	**"Strawberry is the tastiest ice cream flavour"** ● If morality was truly relative, we would not engage in so much debate about what individuals should or should not do: in the same way that we do not argue about whether "strawberry is the tastiest ice cream flavour" because we recognise that this is a matter of subjective personal preference, we would not argue about whether abortion is moral if it was also up to the individual / community to decide ● The fact that we still engage in heated debate over these moral issues reveals our underlying universalist conviction: that moral facts exist and should apply to everyone!
From 'intuition', because we arrive at moral judgments so quickly	**Fat Man Trolley Problem** ● The 'fat man' variant of the Trolley Problem is clearly divorced from reality: we have never encountered or learnt about a situation in real life where one has the choice to push a fat man onto the tracks to stop an out-of-control train and save five lives ● However, the fact that we can make such swift moral judgments about what we should do — without any knowledge from experience and without going through complex moral reasoning — suggests that we have intuitions about moral issues!
From reason, because it allows us to obtain common foundations	**Kant's universalisability and free will** ● Kant does a great job at identifying common, rational assumptions on which all coherent moral systems must be built. ● Kant identifies that morality stems naturally from free will, and this is a claim hard to dispute. This is because our moral discourse assumes free will exists — if our actions were to be fully predetermined, moral discourse would certainly be useless! We also would not praise or punish people for

	moral or immoral acts — they had no agency, after all. --- ● Kant, for instance, offers a formulation of the Categorical Imperative in the form of universalisability: this is necessary and rather indubitable, because a moral law which prescribes its own collapse would encounter a logical contradiction!
Corroborated by a mixture of reason and 'intuition'	**Rawls' Reflective Equilibrium** ● Among reason and intuition, it is not sufficient to justify moral knowledge using only one faculty: ○ Even though utilitarianism might be rationally justifiable, it is still inadequately justified because it contradicts our moral intuitions: that we should not harvest one individual's organs to save five lives, for instance. ○ Even though virtue ethics might be intuitive, its logical circularity ("virtuous people do good acts, and good acts are those that are done by virtuous people") makes it inadequately justified because we cannot justify it via reason ● Therefore, to justify moral knowledge, we need reason and intuition. This is what ethicists rely on: as Rawls argued, they consider rational arguments for an ethical theory and repeatedly check whether the theory coheres with our intuitions and societal conceptions. ● This is an extremely high justificatory bar — that's why we haven't figured out a definitive answer to what is moral!
Justificatory Bar in Ethics	
Extremely high, because we put moral knowledge on a higher pedestal that allows moral reasoning to trump all other pragmatic reasoning **[Normative]**	**Killing civilians in war** ● There might be many pragmatic reasons why we might want to kill civilians in war: it might diminish enemy morale, allow us to use more effective tactics like carpet bombing, or reduce the population that could be conscripted later on in the war ● However, the moral fact that these civilians have a right to life supercedes all other pragmatic reasons to kill them — this shows that moral knowledge, given its normative nature, is placed on a higher pedestal that overrides all other non-moral considerations ● Given the special, supreme importance we accord to moral knowledge, it is imperative that moral claims meet an correspondingly high justificatory bar!
Extremely high, because its normative nature makes the implications of moral judgments wide-ranging **[Pragmatic]**	**Applications of moral knowledge** ● If we manage to conclusively justify a particular moral framework, it would have wide-ranging implications in nearly every sphere since it concerns the actions of every individual and government ○ For instance, if we conclusively determined that utilitarianism is the only justified ethical framework, we would be required to kill healthy individuals to save more sick patients, or torture prisoners of war to extract information that could help us end a war quickly ● Given these drastic and wide-ranging implications, it is pragmatically necessary to make sure that our moral judgments are made correctly, and by extension, are well-justified!

AESTHETICS

Argument	Example(s)	
Defining Art		
Not representation (Aristotle), because of abstract art	**Orchestral Music** ● Well, what is Canon in D representing / commenting on, exactly?	**Architecture** ● Well, what is the Sydney Opera House representing / commenting on, exactly?
Not expression (Hume), because of conceptual art	**Escher's Paintings** ● M. C. Escher's paintings like *Waterfall* and *Relativity* prompted the viewer to consider perspective, but they didn't really express any emotions…	**Warhol's Paintings** ● Andy Warhol's *Campbell's Soup Cans* invited the viewer to think about sameness in the era of commercial production, but it didn't really express any emotions…
Not "significant form" (Bell), because of formless art	**John Cage 4'33"** ● John Cage's 4'33'' is a silent piece, with the performer merely opening and closing the piano keys. It is truly formless, in that sense, but we still consider it to be art	**Morris's *Untitled (Threadwaste)*** ● Robert Morris's *Threadwaste* literally comprised a pile of amorphous remnants from textile manufacturing, without any form to speak of.
Not essential conditions, because of the complex, human-made nature of art	**Wittgenstein's Family Resemblances** ● Wittgenstein considers a variety of things we call 'games': card games, board games, ball games. Nothing seems to universally connect all of them: they merely resemble each other, connected by overlapping similarities rather than one core condition. ● Art could very well be the same kind of thing: artworks resemble other artworks, but they are not universally connected by some kind of core, essential property. ● Art, as a human construct, is diverse and messy: there are so many forms of art, across so many cultures and genres, that each evolve over time. Why would we assume that all art can necessarily be reduced to a few conditions?	
Whatever society deems it to be, because society gives the concept of 'art' meaning /value	**Duchamps *Fountain*** ● Ultimately, the concept of 'art' is only meaningful insofar that we have societal institutions (e.g. museums, critics, auction houses) built around the concept. ● Before Duchamps' *Fountain* was staged at an exhibition, it was just a normal urinal — but it became a piece of art because institutions talked about it as art, and viewers saw it as art. ● In this sense, it is far less important whether a work fulfils some set conditions for society to potentially deem it as art, and more important whether society actually deems it as art. Therefore, finding conditions is not a fruitful endeavour: if society says something is art, it is art.	
Knowledge about Art		

<table>
<tr><td>Uncontroversially possible</td><td colspan="2">Knowledge about the Mona Lisa
I clearly have the ability to know facts about the Mona Lisa: that it is situated in the Louvre, or that it was painted by Da Vinci
That is because we justify these claims using uncontroversially accepted means: for instance, I can use sight to determine that the Mona Lisa is in the Louvre, or I can rely on a credible textbook's account of the Mona Lisa's creation to determine that Da Vinci painted it
Artworks can also uncontroversially serve as evidence to justify claims in other fields, like history or science
For instance, from the Mona Lisa, I can learn that oil paints were invented by the time of its creation in the 16th century, or use it to deduce how varnish might react with air over time
The key thing to note here is that none of these claims pertain to the subject of the artwork, or that which is portrayed!</td></tr>
<tr><td colspan="3">Propositional Knowledge <u>from</u> Art</td></tr>
<tr><td>Perhaps by coincidence</td><td>Arthur Conan Doyle's Sherlock Holmes
From Arthur Conan Doyle's Sherlock Holmes, we might acquire many true beliefs, such as the fact that Baker Street is near Great Portland Street.</td><td>Chinua Achebe's Things Fall Apart
Even though there isn't really an Okonkwo, we can learn a lot about Igbo culture through Achebe's novel — for instance, that yam is a staple for the Igbo community</td></tr>
<tr><td>Not justified, because of the Warrant Challenge</td><td colspan="2">Arthur Conan Doyle's Sherlock Holmes
Artworks are under no obligation to faithfully and accurately represent reality: they can depict fantasy worlds, invent subjects, or exaggerate certain elements of reality
From Arthur Conan Doyle's Sherlock Holmes, we might acquire many true beliefs, such as the fact that Baker Street is near Great Portland Street. However, we might also acquire beliefs that happen to be false: for instance, that there is a house at 221B Baker Street
There is no way of telling from the artwork alone which of these beliefs are true or false — I need to rely on other sources such as maps or historical records. Artworks, therefore, seem to be unable to provide warrants for beliefs, even if we acquire beliefs that happen to be true</td></tr>
<tr><td>Not useful, because of the Uniqueness Challenge</td><td colspan="2">Christopher Nolan's Interstellar
Christopher Nolan's film Interstellar might give us some warranted knowledge about space, because we know it to be a somewhat reliable source: it hired theoretical physicist Kip Thorne to be a scientific consultant, after all
However, there appear to be far better sources of justification for any knowledge we would like to acquire about space: perhaps we should consult journal articles about astrophysics which have undergone peer review, or we should read Kip Thorne's non-fiction books directly!</td></tr>
<tr><td>Subjective, because of ambiguities of meaning</td><td colspan="2">Shakespeare's Hamlet
Hamlet is a morally ambiguous character: although he is protecting his mother and avenging his father's murder, he is willing to kill anyone in his path to vengeance
As such, one reader could take away the belief that revenge is justified</td></tr>
</table>

	when one has suffered a great wrong, while another could believe the play condemns the principle of an eye for an eye ● In this way, artworks appear to leave much room for subjective interpretation, making objective knowledge from art ostensibly impossible
Subjective, because of personal experience	**Joseph Conrad's *Heart of Darkness*** ● While some Western critics consider Joseph Conrad's *Heart of Darkness* to be sympathetic to the plight of African peoples who were conquered and subjugated by imperial powers, others who have lived through colonialism — such as Nigerian writer Chinua Achebe — criticise the book for dehumanising Africans ● In this way, the knowledge claims we glean from artworks appears to depend on our own personal experiences, making knowledge from art inevitably subjective
Relative, because of culture	**Red in paintings** ● While many Western artists use red to represent danger and sacrifice due to its association with blood in Christianity, Asian viewers often associate the colour with connotations of prosperity, luck and happiness in line with Chinese culture, creating completely different interpretations of the same artwork ● In this way, the knowledge claims we glean from artworks appears to depend on our own cultural upbringing, making knowledge from art inevitably subjective
Source of understanding but not knowledge	**Orwell's *1984*** ● Perhaps George Orwell's *1984* does not give us knowledge directly: it cannot provide us justification for our beliefs about totalitarian regimes, and even if it can, other sources like a historian's account of Stalin or Hitler might provide better justification, since they employ the historical method and are built on real-world evidence ● However, *1984* might enhance our *understanding* of these pre-existing knowledge claims about totalitarian regimes: we might not be able to appreciate from an academic account of Soviet Russia how oppressive a totalitarian regime can be, but by reading about how the fictional protagonist Winston Smith is tortured by the authoritarian Party, we might be able to vicariously experience the horror and fear of living under a dictator, and fully understand their oppressive nature
Non-Propositional Knowledge <u>from</u> Art	
Tacit knowledge about skills	**Artistic skills** ● For instance, a painter can gaze upon Da Vinci's *Mona Lisa* and come to know how to adjust the proportion of their own portraits to make them more realistic ● A violin player can listen to the recordings of great soloists such as Menuhin or Hilary Hahn to gain inspiration with regard to how to enhance their vibrato skills ● As such, we can gain ineffable knowledge about skills and faculties, even if they cannot be expressed in propositional terms
Experiential knowledge about experiences	**Tolstoy's *Anna Karenina*** ● For example, in reading Anna Karenina by Tolstoy, readers can learn about what it is like to be stuck in an unhappy marriage through empathising with

	Anna ● As such, we can gain experiential knowledge about what it would be like to be in a situation, even if such knowledge cannot be expressed in propositional terms
Introspective knowledge about one's dispositions	**Austen's *Pride and Prejudice*** ● Jane Austen's *Pride and Prejudice* induces introspection by way of its narrative design, by first misleading us into unjustified hatred for certain characters, before revealing the falsity of our biased prejudgements. In this way, it might allow readers to realise that they were initially prejudiced, and gain self-knowledge about their mental states and dispositions in the process ● While art might prompt us to acquire such introspective knowledge, it does not *justify* or form the warrant to this knowledge, because our introspective beliefs are self-justifying — we would find it absurd to demand that someone produce justification for their claim that they succumbed to prejudice!
Knowledge about one's moral beliefs	*"Moral memories" — Rawls*
	Picasso's *Guernica* ● While Picasso's *Guernica* might not be able to justify claims about the brutality of war, since it does not directly depict any specific conflict in a historically accurate manner, it might evoke feelings of anger, disgust and horror in the viewer that helps them realise that they believe war is immoral. In this way, art can help one gain knowledge about their own moral intuitions and beliefs ● While art might prompt us to acquire such introspective knowledge, it does not *justify* or form the warrant to this knowledge, because our introspective beliefs are self-justifying — we would find it absurd to demand that someone produce justification for their claim that they are horrified by war, or that they intuitively believe war is immoral!
Religious knowledge	**Architecture of cathedrals** ● In many of the cathedrals of Europe, the dramatic arches, tall ceilings, stained glass windows that seems to cast the gentle light from the heavens onto the believers in the Church. The scale and magnitude of these churches are deliberately constructed to make the church-goer feel small and insignificant, cementing their knowledge that there is something "bigger" and beyond themselves that exists in the folds of the divine
Nature of Aesthetic Judgements	
Ostensibly objective, because of some agreement	**McGonagall vs Blake** ● Virtually no one thinks that McGonagall's "The Tay Bridge Disaster" is better than Blake's "The Tyger": the former is notoriously regarded as one of the world's worst poems, while the latter is considered one of the greatest ● The fact that we can all agree that one has more artistic merit than the other and independently come to the same aesthetic judgement appears to suggest that there is something objective and universal about these judgements!
Ostensibly objective, because of seemingly objective	**Hume and Kant's conceptions of aesthetic judgements** ● Philosophers have identified criteria that appear to be able to evaluate the quality of an aesthetic judgement in an objective manner:

criteria that evaluate the quality of judgements	○ Hume lists five qualities that a 'true judge' must possess, such as being united to delicate sentiment or improving one's judgements by practice ○ Kant suggests that aesthetic judgements which are more 'disinterested' — more clearly separated from one's subjective enjoyment of a particular artwork — would be a better one ● As such, we seem to have objective criteria that can identify better aesthetic judgements, and therefore make objective aesthetic judgements as a community!
Not objective, because of infinite regress	**Infinite Regress** ● Under Hume's view, in order to determine if someone has a 'good sense', we need to compare them to someone who has already been objectively ascertained to be a 'true judge' — this 'true judge' in turn needs to be compared to someone else who is a 'true judge', creating a problem of infinite regress! ● Similarly, for Kant to determine whether someone is 'disinterested' when making judgements, we need to have an existing pool of verifiably 'disinterested' judgements to test their judgements against, which in turn must be compared against an even earlier set of 'disinterested' judgements… ● Hence, we cannot objectively determine the quality of an aesthetic judgement!
Subjective, because of personal experience	**Joseph Conrad's *Heart of Darkness*** ● While some Western critics consider Joseph Conrad's *Heart of Darkness* to be one of the greatest texts of English literature, others who have lived through colonialism — such as Nigerian writer Chinua Achebe — believe that it dehumanises African people, denouncing Conrad's writing style and believing it to be of little artistic value ● In this way, our aesthetic judgements seem to depend on our own personal experiences, making them inevitably subjective
Relative, because of culture	**Peking Opera** ● The bold colours of Chinese opera masks might have been brave and beautiful to the Chinese, but might have appalled a Westerner who is not used to seeing such loud colours ● In this way, our aesthetic judgements seem to depend on our own cultural upbringing, making them inevitably subjective
Relative, because of the artistic period	**Impressionist vs Classical art** ● In the Classical age, fine detail, smooth brushstrokes and natural colours were the defining characteristics of a 'good' painting ● However, these standards were abandoned as the Impressionist movement gained steam: Impressionist art was prized for portraying overall visual effects rather than details, with Monet's paintings using coarse brushstrokes and unblended colours in a radical departure from Classical art ● As such, what we consider to be in good taste appears to change over time, making taste and aesthetic judgements of beauty and the sublime relative to the period!
Subjective, because aesthetic judgements cannot be supported	**Pachelbel's Canon in D** ● If aesthetic judgements were objective, it would be possible to support them with deductive arguments that render them incontrovertible

by deductive arguments	○ For instance, I might be able to *prove* my judgement that "Canon in D is beautiful" by pointing to its balanced bass pattern or straight-forward rhythms, if these were objective markers of beauty ● However, we find it absurd to say that my aesthetic judgement is entailed or proven by these reasons: one could, without contradiction, plausibly disagree with my aesthetic judgement even while granting my reasons ● As such, if aesthetic judgements cannot be objectively proven deductively, they have to involve some subjective component!
'Subjective universal' (Kant), which is confused with objective	**Pachelbel's Canon in D** ● When I make the aesthetic judgement that "Canon in D is beautiful", it is a deeply subjective one: I might particularly appreciate the calm melodies of classical music, while my friend who lauds loud rock music might not share my regard for Pachelbel's work ● The reason I might get into an argument with this friend is not because my judgement is objectively right and theirs is objectively wrong, but because I *expect* my subjective judgement to be universally shared and assented to: that is, subjective aesthetic judgements are nonetheless *prescriptive* even though they are not *objective*. ● As such, continued debates over the artistic merit or aesthetic value of works do not point to the existence of an objective judgement we are striving towards, but merely our expectation that our subjective aesthetic judgements are universal (Kant).
Construction of Aesthetic Judgements	
Involves rationalist means, because we have a common understanding of beauty as a concept	**Agreements and debates** ● The near-universal agreement that the *Mona Lisa* is beautiful despite our wildly-varying personal experiences and cultural backgrounds suggests that we do have some common, innate understanding of the concept of beauty such that we can recognise it ● Even in instances where we disagree, the fact that we can debate over whether a piece of art is beautiful or not suggests that we have a common understanding of the concept of "beauty" — otherwise this debate would be completely meaningless! ● As such, aesthetic judgements must partly involve some *a priori* faculty of the mind
Involves empiricist means, because second-hand aesthetic judgements are not possible	**Judging the Mona Lisa** ● If aesthetic judgements were purely *a priori*, we would be able to make second-hand judgements of the Mona Lisa's beauty from a description alone, without ever encountering a picture of it or seeing it in the Louvre ● This intuitively seems absurd — it seems that I cannot judge whether the Mona Lisa is beautiful if I haven't seen it for myself! ● Hence, aesthetic judgements must involve personal experience as well
Involves 'intuition' — because judgements are really fast!	**Mountaintop** ● When I reach the mountaintop, I can make a snap judgement that the view is beautiful and breathtaking — I don't need to rationally analyse why it is beautiful, nor compare it to other beautiful things and observe the similarities and differences.
Justificatory Bar in Aesthetics	

Intersubjectivity, because we want to share beauty	**Critical debates and award shows** ● That said, there is still value in determining *intersubjectively* which aesthetic judgements enjoy the most consensus in society — this is because we want to share beauty (Nehemas)! ○ That is the reason we still have debates between art critics over which paintings, sculptures or movies are the best, and that is why we still have the Oscars and the Grammys that gather the judgements of critics and give out awards — we want to share what we are likely to consider beautiful! ● We don't need these critical debates to produce an universal judgement, neither do we need the verdicts of these award shows to be objective — we know that people's tastes differ. However, we just need them to come to intersubjective aesthetic judgements, so that we can share and spotlight artworks that *most people* will *most likely* judge to be beautiful.

KNOWLEDGE AND SOCIETY

Factor	Aesthetics	Ethics	History	Social Science	Science	Mathematics
Culture	**Red in paintings** ● While many Western artists use red to represent danger and sacrifice due to its association with blood in Christianity, Asian viewers often associate the colour with connotations of prosperity, luck and happiness in line with Chinese culture, creating completely different interpretations of the same artwork	**Honour killings** ● In the Middle East and North Africa, some communities accord greater moral importance to the dignity of the family than to the life of the individual who has committed a dishonourable act. As such, it is seen as morally acceptable or even necessary to murder the individual who has brought shame to the family, even though this is an immoral act by Western conceptions of morality	**Asian values in Asian Tigers** ● History is, at some level, affected by cultural factors — the miraculous economic growth achieved by South Korea and Taiwan in the 1970s and 80s are in part attributable to the culture of hard work and respect for authority ● A historian from another culture — say the West — may not be able to appreciate those intangible cultural aspects that catalysed success	**Slurping soup** ● A social scientist from America seeking to study dining etiquette in Japan might be very much appalled initially by their loud slurping — even though it is considered a mark of respect and appreciation for the chef, the social scientist is likely to be influenced by his own cultural perception of slurping as impolite		
Race	**Joseph Conrad's *Heart of Darkness*** ● While some Western critics consider Joseph Conrad's *Heart of Darkness* to be sympathetic to the	**Affirmative action** ● Someone of a minority race is more able to appreciate the way racism might be systemically perpetuated by social	**Igbo oral history** ● The racial background of a historian can impact their ability to access certain historical sources — for example, an Igbo	**"Systemic racism"** ● A social scientist of a minority race is more able to appreciate the way racism might be systemically perpetuated by social		

Factor	Aesthetics	Ethics	History	Social Science	Science	Mathematics
	plight of African peoples who were conquered and subjugated by imperial powers, others who have lived through colonialism — such as Nigerian writer Chinua Achebe — criticise the book for dehumanising Africans	institutions, and thus be more likely to regard policies like affirmative action as ethically necessary to achieve equality ● Conversely, someone of a majority race might regard affirmative action as an affront to equality	historian of African descent might have better access to oral histories and community archives within the Igbo community, whereas a Western historian might be confined to secondary accounts	institutions — it is no wonder that the term "systemic racism" was first coined by the African American writer and activist Kwame Ture		
Religion	**Salman Rushdie's *The Satanic Verses*** ● While Rushdie's *The Satanic Verses* was praised by many and shortlisted for the Booker Prize for its literary merit, many Muslim readers disagreed that it was a great work of art, instead regarding it as blasphemous due to its portrayal of the Prophet Muhammad	**Eating pork / beef** ● Under Islamic teaching, eating pork is *haram* and sinful, and Hindus abstain from eating beef due to their belief that the cow is a sacred animal ● However, such meat consumption would be perfectly acceptable in many other religions	**Israel-Palestine conflict** ● A Muslim historian is likely to select sources that emphasise Israeli aggression towards Palestine, whereas a Jewish historian is more likely to foreground Israeli vulnerability and the need for a Jewish state after the Holocaust	**Leaving the Mormon church** ● A secular sociologist — without any lived experience in the Mormon community — might not be able to appreciate the ostracisation and shame that some people who leave the Mormon church experience ● This affects their ability to craft appropriate questions…	**Creationism** ● Darwinian ideas of evolution were — and continue to be — rejected by many religious leaders as it contradicts the Creationist narrative of many religious texts	
Gender	**Daniel Defoe's *Robinson Crusoe*** ● Daniel Defoe's *Robinson Crusoe* is regarded by many as a timeless classic, but many female readers in recent years have challenged its artistic merit based on its sexist portrayals of women given as gifts to the men of Crusoe's newly colonized island	**Abortion** ● More women tend to be pro-choice — some scholars have argued that this is because they are better able to appreciate the toll pregnancy takes on a woman's body, and also the sacrifices women have to make to raise a child ● Their gender, therefore, affects their ethical positions	**Suffrage movement** ● A female historian — more sensitive to the historical injustices women faced in a patriarchal socal order — might be inclined to place greater emphasis on the suffrage movement when writing an account of early 20th-century political history	**Judith Butler** ● A social scientist's gender might affect their ability to recognise the effect of gender in everyday life — it is no wonder that Judith Butler, as someone who identifies as non-binary — is able to see how gender as a construct is performed and reified		
East / West	**Peking Opera** ● The bold colours of Chinese opera masks might have been brave and beautiful to the Chinese, but might have appalled a Westerner who is not	**Asian prioritisation of filial piety** ● An Asian child, living in a community where moral virtues of filial piety are preached and practised frequently, is more likely to grow up	**Asian values in Asian Tigers** ● History is, at some level, affected by cultural factors — the miraculous economic growth achieved by South Korea and Taiwan in the 1970s	**Slurping soup** ● A social scientist from America seeking to study dining etiquette in Japan might be very much appalled initially by their loud slurping — even though it is	**TCM vs Western medicine** ● Informed by the Chinese conception of yin and yang, TCM focuses on making sure elements and forces within the body are in balance — some	

Factor	Aesthetics	Ethics	History	Social Science	Science	Mathematics
	used to seeing such loud colours	believing in the moral importance of filial piety, whereas a Western child, living in a community where individualism is emphasised, is likely to place less moral weight on filial piety	and 80s are in part attributable to the culture of hard work and respect for authority ● A historian from another culture — say the West — may not be able to appreciate those intangible cultural aspects that catalysed success	considered a mark of respect and appreciation for the chef, the social scientist is likely to be influenced by his own cultural perception of slurping as impolite	herbs are 'cooling' while others are 'heaty', while acupuncture seeks to improve 'circulation' ● Western medicine would reject all this as 'unscientific', and focus on a heavily biochemical approach — using drugs like paracetamol to treat pain rather than acupuncture	
Language	**Camus' *The Stranger*** ● Camus' *The Stranger* begins with "Aujourd'hui, Maman est morte", a line that is notoriously difficult to translate — Maman is not as intimate as "mummy", but also not as detached as "mother" ● The lack of an English equivalent for the French Maman limits an English reader's ability to appreciate the exact nuance of Camus' text		**"Invasion" vs "Military Operation"** ● Russian accounts of the war in Ukraine neutrally call it a "special military operation", while Western accounts condemn it as an outright "invasion" ● Hence, the language that the historian employs is loaded with connotations and associations that create subjectivity	**"Terrorist vs Shooter"** ● Oxford study found that public perceptions of an attacker were far more negative when he is labelled a "terrorist" rather than a "shooter"		
Politics	**Picasso's *Guernica*** ● Picasso's powerful anti-war painting depicting the bombing of the town of Guernica during the Spanish Civil War was deemed controversial by the Spanish government at the time, and it was banned in Spain until the end of Francisco Franco's regime in 1975 ● This, of course, prevents us from accessing artworks, let	**Death penalty** ● Across many Western liberal democracies, a longstanding emphasis on human rights and dignity has led many to believe the death penalty is immoral ● Conversely, many illiberal regimes retain the punishment (e.g. China) because it is regarded as an acceptable use of state power	**Tiananmen Square** ● The deadly events of June 4, 1989 are erased from the official historical record in China, even though the massacre is commemorated abroad ● Political interests result in the manipulation of history	**Rise of neoliberalism** ● The rise of neoliberal economics in 1980s America was fuelled in part by a wave of research from conservative think-tanks indicating the merits of trickle-down economics — it seems that ideological alignment can affect research methodology and eventual social scientific knowledge	**Lysenkoism** ● Lysenko rejected Mendelian genetics in favour of Lamarckian ideas of inheriting acquired characteristics ● Because of Stalin's personal support of Lysenko's ideas, such bogus science was proliferated and other contradicting science was banned	

	Ethics	History	Social Science	Science
n them!		**Origins of the Cold War** ● An American historian growing up in the Cold War may subconsciously select more Western government accounts, attributing more responsibility for the start of the Cold War to the expansionist tendencies of the Soviet Union		

RELIGION

Argument	Example(s)
Nature of Religious Knowledge	
Laden with ontological assumptions	**Holy Spirit** ● Religious knowledge that a Christian gains through revelation from the Holy Spirit is contingent on the existence of the Holy Spirit in the first place — this requires one to believe the rather complex ontological arrangement of the Trinity, where God exists equally as the Father, the Son and the Holy Spirit, and the latter can speak to us and guide us to truth… ● A contorted and convoluted ontology, if you ask any non-Christian. This violates Occam's Razor, which recommends searching for explanations constructed with the smallest possible set of elements.
Unprovable, from an a priori perspective	**Failure of Descartes' Ontological Argument** ● Descartes famously sought to prove the existence of God through logic, as follows: ○ P1: Our idea of God is of a perfect being ○ P2: It is more perfect to exist than not to exist ○ C: God must exist ● Such arguments have been largely discredited over the years — for instance, it is unclear why existence is necessary for perfection, if I can imagine a perfect circle (which I cannot possibly draw). ● Of course, this is merely one of many ontological arguments — but the general lack of acceptance of any of these arguments suggests that God's existence cannot be proven, a priori.
Unfalsifiable	**Claims about the afterlife** ● Buddhists believe in karmic reincarnation, while many Abrahamic religions preach some version of the afterlife — Christians believe that after we die, we either enter a perfect heavenly realm or suffer damnation in hell ● These beliefs are uniquely unfalsifiable — how are we to verify if heaven, hell or rebirth actually exist?

Inconsistent between religions	**Eating meat** ● Religions vary widely on their prescriptions vis-a-vis the consumption of meat: Islam prescribes that eating pork is haram and sinful, whereas Hindus avoid eating beef because they believe it is a sacred animal. Christians, however, have no such inhibitions. ● The presence of such inconsistency suggests that religious beliefs cannot be objective, and perhaps are unlikely to be true…
Inconsistent within the same religion	**Catholic vs Protestant beliefs** ● Beliefs among Christian denominations vary widely — the Catholic Church believes in sainthood while Protestant denominations largely reject them; Protestants believe that one is saved by faith alone, while Catholics regard works as also necessary. ● The fact that Christians cannot interpret the Bible in a uniform manner suggests that religious beliefs are certainly subjective to some degree
Incorrigible, because of the private nature of religious experiences	**Mountaintop** ● Many theists who climb mountains claim to have felt close to God at the mountain summit — some say they have gained a newfound understanding of his greatness, some say they experience a feeling of great certainty in his presence ● You could say, perhaps, that these are hallucinations or illusions — but even if these believers are mistaken about the source of their experience, they cannot be mistaken about the fact of their experience!
Construction of Religious Knowledge	
Through revelation	**Moses and the Ten Commandments** ● In Exodus, the Ten Commandments are revealed by God to Moses atop Mount Sinai — it seems like religious knowledge can be revealed directly to believers.
Through religious experiences	**Mountaintop** ● Many theists who climb mountains claim to have felt close to God at the mountain summit — some say they have gained a newfound understanding of his greatness, some say they experience a feeling of great certainty in his presence
Through art	**Architecture of cathedrals** ● In many of the cathedrals of Europe, the dramatic arches, tall ceilings, stained glass windows that seems to cast the gentle light from the heavens onto the believers in the Church. The scale and magnitude of these churches are deliberately constructed to make the church-goer feel small and insignificant, cementing their knowledge that there is something “bigger” and beyond themselves that exists in the folds of the divine
Justificatory Bar in Religion	
Leaps of faith are acceptable, because religious systems emphasise the limits of mortal perception	**Isaiah 40:28** ● To the atheist, we need to show that a method can lead to knowledge: we need to use logical proofs to justify theorems in mathematics, or conduct experiments to verify hypotheses in science. ● To the religious inquirer, this is a strange demand: how would I show that a direct revelation from the divine being (the source of knowledge) is able to produce knowledge, and why would I have to?

	● In fact, trying to show that a method is rationally justified will always be a fruitless endeavour, because many religions emphasise the mortal limitations of human perception: there will always be elements of God's work that humans cannot understand. For instance, consider Isaiah 40:28: "his understanding no one can fathom". ● Of course, gaining religious knowledge through religious experiences / revelations requires leaps of faith: but these are not unacceptable to the religious inquirer, but instead form the very bedrock of religious teaching!
Religious and secular inquiry operate on different epistemic paradigms	**Epistemic laziness vs epistemic hubris** ● Debates between atheists and theists will always exist, because religious knowledge and other secular fields of knowledge don't operate on the same assumptions: the secular inquirer dismisses all that does not conform to reason, while the religious inquirer questions whether we should rely completely on rationality at the expense of religious insight. ● A secular inquirer could — in the secular paradigm — accuse a religious inquirer of epistemic laziness, clinging to dogma without seeking justification. But equally, a religious inquirer could — in the religious paradigm — accuse a secular inquirer of epistemic hubris, excessively confident in his ability to know how the world works without depending on the divine.