PHIL 145
Personal Notes

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Chapter 1: The Basics

WHAT IS CRITICAL THINKING?

The objective of any course in critical thinking is to provide students with intellectual tools and the prowess to utilise them to better comprehend and analyse arguments.

WHAT ARE ITS ADVANTAGES?

① The ability to analyse someone's arguments helps us better understand complex material, as it helps us understand how it is organised.

② We can use critical thinking skills to formulate good arguments for our own personal use.

REAL-WORLD APPLICATIONS OF CRITICAL THINKING

Critical thinking is prevalent in many areas of society:

① Democracy relies on citizens making well-informed decisions about politics, which requires proficient critical thinking skills.

② Critical thinking is the bedrock of many academic disciplines (eg history).

③ Good critical thinking skills allows us to safeguard against potential scams / exploitative people.

THE ARGUMENT : AN OVERVIEW

1. An "argument" is a set of declarative sentences, where one is designated to be the conclusion and the rest of which are the premises.

2. A "premise" is a reason being offered that (in theory) supports the conclusion.

* Note: often, premises may be conclusions of smaller arguments, ie "subconclusions of subarguments", that form part of the argument as a whole.

** Note: when people express arguments, they may use non-declarative sentences (eg rhetorical qns). Note that the content of what they are conveying can be expressed using declarative sentences.

IS AN ARGUMENT BEING PRESENTED?

1. Generally, if the author attempts to establish whether a claim (stated / unstated) is true, the author is presenting an argument.

2. Often, an author may do something else to establish their claim; in this case, they are NOT establishing an argument.

3. One example of the above is that if the author attempts to solve "why something happened" or "why something is the way it is", instead of showing the claim is true using logic, they are not presenting an argument, but rather an explanation.

4. An easy way to differentiate arguments and explanations is that when presenting an argument, the conclusion is usually regarded as contentious/open to doubt / needing defense; an explanation simply assumes either the validity of the claim, or vice versa.

5. When writing arguments, whether we can take something for granted (ie omit a "trivial" fact) is highly dependent on the audience the argument is meant for.

6. TL;DR: arguments present reasons; explanations present causes

WHAT ARGUMENT IS BEING PRESENTED?

There are many ways we can decipher the subject of a particular argument from its content.

① Certain "indicator words" usually show the clauses/sentences that succeed them are meant as premises,
eg since, because, as a result of, etc
or a conclusion.
eg therefore, hence, so, etc.

* note: this is not always the case. (IWs may not point towards a premise / conclusion.)

② We can use IWs to figure out the author's conclusion, and subsequently use it to find the corresponding premises. (This is easier than vice versa.)

* note: make sure to find the main conclusion, not a "sub" (intermediate) conclusion.

③ Then, we can find out what the author intends her premises to be.

→ To make use of this info, we employ the "principle of charity": the author is attempting to present their strongest argument.

→ TL;DR: we give the author the benefit of doubt.

Chapter 2:
The Structure of Arguments & The ARG Conditions

STANDARDISING ARGUMENTS

Although the official def^n of an argument is correct, it fails to take into account that there are many other ways sentences can be linked together. (ie it does not take into account subarguments, etc.)

THE CONCLUSION

When identifying a conclusion, make sure you consider

① the context in which it was written in; (ie audience, time, location etc.)

② its "strength"; and (ie is the claim contended to be "certainly true", or only "likely"?)

③ its scope. (ie does the claim apply to all cases, or only some?)

THE PREMISES

When identifying premises, make sure you consider:

① not all premises will take the form of declarative sentences; & eg they might be rhet. qns instead, etc.

② not all the premises that are needed to form a complete argument will be present. ie there are "unstated" premises.

WHY STANDARDISE?

1. Standardisation helps lay the argument out in a way that is easy to comprehend, and hence easier to evaluate.

2. It also allows us to visualise subarguments and subconclusions.

3. Before we standardise, we must:
   a) convert all premises into declarative sentences; and
   b) number each premise in sequential order; &
   c) make sure, individually, no conclusion or premise expresses an argument.

Why a)? → easier to see what the claim is about.

Why b)? → easier to refer to each individual premise.

Why c)? → otherwise, we cannot properly identify a flaw in an argument which goes wrong.

HOW TO STANDARDISE

1. To standardise an argument, we set out its premises in clear statements, with the premises preceding the conclusion.

Ex_a 1 The argument

It is a mistake to think that medical problems can be treated solely by medication. First, medication does not address psychological and lifestyle issues. And second, medication often has side effects.

would be written as

each statement is numbered.

1. Medication does not address psychological and lifestyle issues.
2. Medication often has side effects.

premises

"therefore" is used to indicate the conclusion.

Therefore,

3. Medical problems cannot be treated solely by medication.

conclusion.

2. We can represent subarguments in our standardisation models too.

Ex_a 2 The argument

The purpose of life in general is not something that can be known. That's because every life has a different purpose, given to it by the person leading that life. Only the person leading a life can give it a purpose.

would be written as

① Only the person leading a life can give it a purpose.

thus is used to indicate a sub conclusion.

Thus,

② Every life has a different purpose, given to it by the person leading that life.

a subargument.

Therefore,

③ The purpose of life in general is not something that can be known.

the conclusion.

3. We can also use standardisation to fill in "logical gaps" caused by unstated premises.

→ There are a number of reasons why premises may be missing from an argument:

① A premise may be considered common knowledge; or

② A part of the argument that is made explicit might be considered to imply the author is committed to a different claim;

amongst other reasons.

*note: even when considering the Principle of Charity, we must recognise authors sometimes make bad arguments.

…, we still need to recognize the fact that sometimes people … Part of the task of deciding whether or not to standardize an argument by adding a missing premise is deciding whether the arguer *intends* to express an argument of which that missing premise is a part, or whether they intend to present an argument which happens to have a logical gap in it.)

Remark: There's no real conflict between our advocating the principle of charity when deciding what argument is being offered and our suggestion that we sometimes should represent people as presenting arguments with logical gaps in them. It is quite common that any premise we might add to the argument which would fill this logical gap is a particularly implausible one, and so it is more charitable to represent the arguer as not having spotted the gap in her argument than as accepting such an implausible claim.

…premise, but there is no evidence which tells us which of these possibilities the author intends, the principle of charity tells us that we ought to add the *most reasonable* premise which fills the gap. (This is the most sensible premise to add because it ensures that when we evaluate the argument any flaw we find in it is one we can attribute to the arguer, and is not a problem we have introduced into the argument ourselves when we added the premise.)

Ex_a 3 The argument

In fact, the ordinary orange is a miniature chemical factory. And the good old potato contains arsenic among its more than 150 ingredients. This doesn't mean natural foods are dangerous. If they were, they wouldn't be on the market.[4]

would be written as

1. If natural foods such as potatoes and oranges were dangerous, they would not be on the market.
2. Natural foods such as potatoes and oranges are on the market.

premises

the underline means this is an "added" premise (one that isn't in the original argument.)

Therefore,

3. Natural foods such as potatoes and oranges are not dangerous.

conclusion.

*note: since 2. is common knowledge, it does not misrepresent the argument.

DIAGRAMMING ARGUMENTS

1. Although standardising arguments makes them more comprehensible, it fails to reflect how premises are related to another.

2. To show the links between premises, we can use go one step further and diagram our arguments.

WAYS PREMISES SUPPORT CONCLUSIONS

CONVERGENT SUPPORT

Two premises 1 and 2 provide convergent support if they support the conclusion independently.

eg
1. Debbie has an A+ in history.
2. Debbie also has an A+ in physics.

Therefore,

3. Debbie is probably very bright.

LINKED SUPPORT

Two premises 1 and 2 provide linked support if they support the conclusion if taken together, but NOT if taken individually.

eg
1. If my dog has fleas, there are probably fleas in my bed.
2. My dog has fleas.

Therefore.

3. My bed probably has fleas.

COUNTER-CONSIDERATIONS

A premise 1 is a counter-consideration if it opposes the conclusion being argued for.

eg (for the prev example) a counter-consideration could be

1. Debbie flunked her maths test.

REBUTTALS

A premise 1 is a rebuttal if it opposes a counter-consideration.

eg for the prev example, a rebuttal could be

2. Debbie was very sick when she took her maths test.

STEPS TO DIAGRAM

We first standardise our argument. Then:

i) We associate every sentence in the list in our diagram with a circle with its number.

ie 1, 2 etc

* we put the conclusion at the bottom, to make it easier to read.

ii) To show a premise 1 supports a (sub)conclusion 2, we draw a straight arrow from 1 to 2.

ie 1 → 2.

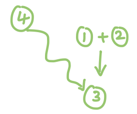
* so, sub-conclusions will have arrows from and to it, whereas conclusions will have arrows only to it.

iii) If two premises 1 & 2 provide linked support (for a (sub)conclusion 3), we put a "+" between 1 & 2, and draw a single arrow from the set to 3.

ie 1 + 2 → 3.

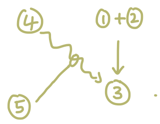
iv) If a premise 4 is a counter-consideration, we draw a wavy line from the circle with its number to the conclusion it weighs against.

ie



v) If a premise 5 is a rebuttal, we draw a straight line with a circle at its head from the rebuttal's circle to the wavy line corresponding to the counter-consideration.

ie



EXAMPLES

LINKED

Consider the previous example for linked arguments. Diagramming, we get

1 + 2 → 3.

CONVERGENT

Consider the previous example for convergent arguments. Diagramming, we get

1 → 3 ← 2

COUNTER-CONSIDERATIONS & REBUTTALS

1. Lastly, we will look at a more complex argument which also utilises counter-considerations & rebuttals.

Consider the argument

Listen Copper, you've got the wrong guy! You've got one witness who picked me out of a lineup, but she's blind as a bat! You think my past record makes me a likely suspect, but purse-snatching ain't like armed robbery at all! And besides, my Ma will tell you I was practicin' with the church choir at the time of the robbery.

2. Standardising, we get

1. The person arrested was picked out of a police lineup by a witness.
2. The witness has very poor eyesight.
3. The person arrested has a criminal record including purse snatching.
4. The person is accused of armed robbery.
5. Armed robbery is not relevantly similar to purse-snatching.
6. The mother of the person arrested says he was practicing with the church choir at the time of the crime.
7. The police have arrested the wrong person.

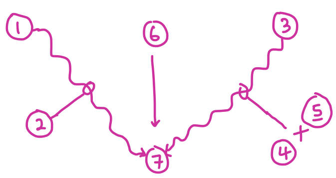
* 1 and 3 are counter-considerations.
* 2 and 4 are rebuttals.

2 corresponds to 1, & 4 corresponds to 3.

* 5 is a missing premise that is common knowledge.

6 is a premise.

3. Finally, we diagram.



EVALUATING ARGUMENTS

Whenever any argument is presented (to convince someone a conclusion is true), the arguer is committing themselves to at least 2 claims:

i) all the premises are (reasonably) true; and

ii) the conclusion is adequately supported by the premises.

WHAT MAKES A GOOD ARGUMENT?

VALID ARGUMENTS

1. An argument is (deductively) valid if knowing the truth of all the premises is sufficient to show definitively that the conclusion must also be true.

2. Note that a valid argument can have false premises, and/or false conclusions.

eg
1. All cats speak Spanish.
2. Dogs are cats.

Therefore,

3. All dogs speak Spanish.

*notice: validity only says if all the premises were true, then the conclusion is true.

→ Obviously, both premises & the conclusion is false, but the argument is valid nonetheless.

"ADEQUATE SUPPORT"

1. We say, in any argument, that the premises only provide "adequate support" for the conclusion if the truth of all the premises makes the conclusion probable, but not definitively true.

SOUND ARGUMENTS

1. An argument is "sound" if both
   ① all its premises are true; &
   ② it is valid.

Notice how this implies any sound argument must have a definitively true conclusion.

2. However, it may be almost impossible to consistently use sound arguments, as we have no reliable method to verify the truth of a premise.

GOOD/COGENT ARGUMENTS

1. A good / cogent argument is an argument whose acceptable premises provide sufficient support for its conclusion.

2. Since we only require the premises to simply be "acceptable" rather than true, we can determine whether a given argument is cogent, whereas we cannot show whether it is sound.

THE ARG CONDITIONS

The ARG conditions can be used to see whether a given argument is cogent or not.

A FOR "ACCEPTABILITY"

For this step, we consider whether each premise something we would consider to be reasonably true : ie acceptable.

G FOR "GROUNDS"

For this step, we consider whether the premises would collectively provide sufficient support, or "good grounds", for thinking the conclusion could be true.

*note the word "collectively": we must consider the premises as a group.

R FOR "RELEVANCE"

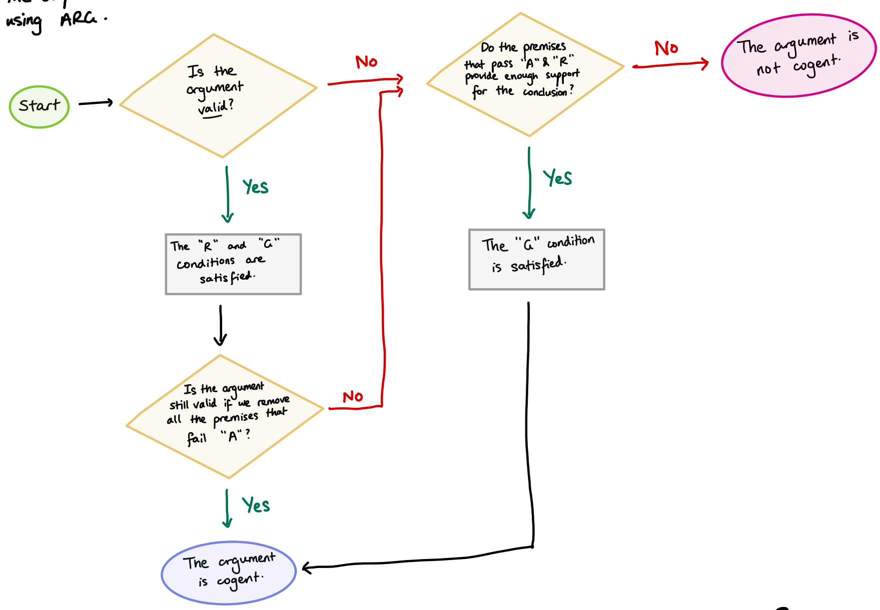
For this step, we consider whether the premises provide any reason at all, irregardless how slight, for thinking the conclusion could be true.

*[1] Note: we need to consider linked premises together when performing the test.

*[2] In this test, we consider each group of linked premises. If a premise is not linked to each other, we consider it in isolation.

USING ARG TO FIND WHETHER AN ARGUMENT IS COGENT

We can use a flow diagram to illustrate the steps needed to evaluate an argument using ARG.



WHY IS KNOWING WHETHER AN ARGUMENT IS COGENT IMPORTANT?

IF AN ARGUMENT IS COGENT

1. If we decide an argument is cogent, we must conclude there exists good reasons for accepting the conclusion (even if we do not find it appealing.)

2. This does not imply we need to accept the conclusion to remain rational; after all, cogent arguments are not necessarily valid.

3. Furthermore, even a valid argument might contain premises that we can see to be acceptable, but not certain — this also makes the conclusion likely, but not necessarily true.

IF AN ARGUMENT IS NOT COGENT

1. If we decide an argument is not cogent, we must conclude the arguer did not provide us with good reasons for believing the conclusion.

2. However, this does not mean we have to think the conclusion is false: it might just mean the arguer does not know (or has not used) a good / better argument.

AN ARGUMENT IS COGENT, OR IT IS NOT.

1. When we evaluate someone's argument, we cannot merely reject their conclusion, nor even offer our own reasons for a conclusion contrary to theirs.

2. Rather, we must either
   ① find the flaw in their argument, showing it is not cogent; or
   ② accept the argument is cogent after all.

Chapter 3: Language

LANGUAGE USAGE, ARGUMENT STRUCTURE & COGENCY

AMBIGUITY

A term is ambiguous if it is not clear, in some context, which of the two or more meanings it represents.

e.g. "Watch out! That food is hot!"
"temperature" hot? or "spicy" hot?

EQUIVOCATION

1. An arguer commits a fallacy of equivocation if their argument fails to be cogent due to ambiguity.

* we might also say they are "guilty of equivocation", or that the argument "trades on an ambiguity."

2. Any argument that commits the FoE breaks at least one of the ARG conditions; however, which one it breaks depends on how we analyse the premises.

eg

1. If the space between two objects is empty, there is nothing between those two objects.
2. If there is nothing between two objects, they must be right up against one another.

So

3. No two objects could have empty space between them.

Therefore,

4. There is no such thing as empty space.

However, if we accept that "nothing" has 2 meanings, then clearly premise 1 + 2 does not imply premise 3! Looked at it this way, we can see that the argument fails the "G" condition.

Notice: if "nothing" means "not even distance", premise 1 is unacceptable; but, if "nothing" means "nothing but distance", premise 2 is unacceptable.

So, if we have to hold meanings constant, this argument fails the "A" condition.

3. Therefore, to show an argument is guilty of equivocation, it often helps to see which term has 2 meanings, and paraphrase each of these meanings in other words so the different meanings can be identified.

VAGUENESS

1. A word is vague when the meaning of said word is unclear, or that the word might apply to "borderline cases".

eg
This is definitely red.
This is definitely pink.
Is this red or pink? (Borderline case — so this is "vague"!)

2. Vagueness can cause problems in arguments; eg when a premise uses a vague term, and applies it to a borderline case. (So the argument fails the "A" condition!)

eg

1. A person with no hairs on his head is bald.
2. Adding one hair to the head of someone who is bald does not make *him* not bald.

Therefore

3. A person who has 10 000 hairs on his head is bald.

Notice: we might consider premise 2 to be unacceptable, because adding 1 hair might make a person "less bald"!
("Bald" is vague in this context.)

EMOTIONALLY CHANGED LANGUAGE

1. We coin the term "emotionally changed language" to describe any argument that has been influenced by the arguer's own opinion, simply by their choice of words.

eg "professor" — normal.
"ivory tower intellectual" — insult (so ECL!)

2. ECL can also occur when a sentence is loaded up with adjectives with good or bad connotations; ie editorial comments.

eg "that moron Devidi cannot make his mind about anything!"
speaker thinks Devidi's indecisiveness is a bad thing!

3. When analysing an argument, we can replace ECL with more neutral content to see whether the premise has any grounds or not.

EUPHEMISM

1. An euphemism is the use of deliberately bland terms to refer to something where a more direct / blunt manner of referring to it would be alarming, embarrassing or impolite.

eg referring to a "huge deficit" as a "cash-flow problem", or a "death" as them "being gone".

2. We can often identify arguments that fail "G" by replacing euphemisms with more literal statements.

DEFINITIONS

In general, a definition helps us comprehend a hard-to-understand claim or argument, or define a term/phrase.

OSTENSIVE

An ostensive definition explains what a thing is by "pointing" at examples of that thing.

eg "red" is the color of the fire hydrant.

REPORTIVE / LEXICAL

1. A reportive, or lexical, definition uses important properties and characteristics of the things/concepts the term describes to define it; ie the word's literal meaning.

eg "a mountain is a large mass of rock of considerable height".
features of a mountain!

2. A reportive definition might possess one or more of these flaws:

① The definition is too broad/narrow;
eg "a calculator is a device with buttons on it".
↳ this refers to other things too! (eg mouse)

② A word that is not negative is defined negatively;
eg "a computer is not a type-writer".
↳ what does this even mean?

③ The features referenced are trivial, not significant;
eg "a chair is brown, and has legs".
↳ these features are not "necessary", and are vague.

④ The terms used in the definition are obscure; or
eg "eating is masticating, humectating, ..."
rarely used words!

⑤ The definition is circular.
eg "a presumption is something presumed to be true."
the word to be defined is used to define that word! (so circular.)

STIPULATIVE

A stipulative definition specifies how the term is to be interpreted, usually to make the meaning more precise or to restrict the meaning for a more practical use.

eg "a full-term student refers to anyone that has completed eight semesters."

OPERATIONAL

An operational definition is a type of stipulative definition, where "concrete" examples are used to define an abstract term.

eg "if you place an object into water, it is soluble if it dissolves."
"concrete" (real-life) example.

PERSUASIVE

1. A persuasive definition is a stipulative definition, or reportive definition, disguised as a claim.

2. Often, the purpose of a persuasive definition is to attempt to change attitudes by utilising words associated with strong emotional connotations.

eg "teachers are nothing but babysitters!"
↳ "nothing" has a strong emotional connotation!

3. However, persuasive definitions can cause problems in arguments where the newly defined term occurs alongside the same term in its everyday context.

eg def$^{\underline{n}}$: "a man is someone that doesn't cry!"

stipulated def$^{\underline{n}}$.

arg:

1. Real men don't cry.
2. Teenage boys are anxious to become men.

Therefore,

3. Teenage boys should avoid crying.

everyday def$^{\underline{n}}$.

(So the argument either fails "A" or "G").

*note: this is also an instance of a fallacy of equivocation, albeit harder to spot.

ACCEPTING & REJECTING PREMISES

1. Whenever we inquire about a premise's acceptability, we are always asking whether a certain person — which could be us — finds it acceptable or not.

2. We will assume that a premise's acceptability depends on whether we accept it or not for this section.

3. Note: even if we do not find the premises unacceptable, it does not imply we have to reject the conclusion!

4. Remember, when we accept premises, we always do so with a certain "confidence level".
   (how confident are we that a certain premise is acceptable ?)

ACCEPTABILITY CONDITIONS

CONCLUSION OF A COGENT ARGUMENT

1. A premise is acceptable if it has been established as the conclusion of a cogent subargument, or is the conclusion of an external cogent argument (ie presented somewhere else.)

NECESSARILY TRUE (PRIORI)

1. A premise is also acceptable if it is obvious it is true, and it is a objectively true statement (aka a priori).
   eg "the sky is blue".
   → it is obvious it is true; &
   → it is objectively true. (Not subject to opinion!)

2. Whether a premise is necessarily true does not depend on the arguer's audience, but whether the premise's truth is obvious does!
   eg "the sky is blue" — obvious, true
   "viruses are smaller than bacteria" — true, may not be obvious (depends on audience!)

COMMON KNOWLEDGE

1. A premise can also be acceptable if it is accepted as common knowledge.
   (eg "the sky is blue".)

2. However, note that
   ① Common knowledge does not imply everyone knows it;
   eg "every living creature has a reproductive system".
   → many children do not know this is true.
   ② what is common knowledge to one audience might not be for another; &
   ③ Common knowledge does not imply the statement is definitively true.
   (Common knowledge only affirms us it is widely known and accepted.)

RELIABLE TESTIMONY

1. A premise could also be considered acceptable if the arguer can provide a reliable testimony to convince us of its acceptability.

Example: "As the impoverished father of three children, I can say that it is hard not to buy expensive sports equipment for children whose school virtually requires that they have such equipment."

2. For a testimony to be reliable, we must:
   ① Have no reason for doubting the person,
   eg we have no history of them being unreliable, etc.
   ② Have no reason for doubting the claim; and
   eg the claim is not wildly implausible, etc.
   ③ Be able to attest that the case is suitable.
   ie the claim can be backed up by anecdotal evidence.

APPROPRIATE APPEAL TO AUTHORITY

1. A premise can also be acceptable if the arguer makes an appropriate appeal to authority, either because they are an authority on the matter themselves, or because they have cited an authority who can back up the premise.

2. To evaluate said appeal, we must consider whether:
   ① The "authority" is an authority on the subject under consideration;
   ② There is any reason to suspect them of bias / dishonesty;
   ③ Whether the subject matter is one where there is general agreement among experts; &
   ④ the arguer has reliably cited the authority (if they are not the authority figure themselves.)

   *note: if we doubt this, we can always ask the arguer if they are in front of us.

CONDITIONAL ACCEPTANCE

1. In special cases, we might only need conditional acceptance of the premise to evaluate the argument.

There are two instances where we use this:

REDUCTIO AD ABSURDUM

1. Reductio ad absurdum is a way of showing a particular statement is false, by demonstrating that if it were true, it leads to a contradiction (ie absurd.)

CONDITIONAL PROOF ("FOR THE SAKE OF ARGUMENT")

1. In a conditional proof, we show that if something was true, it implies other things are true; ie "for the sake of argument".

UNACCEPTABILITY CONDITIONS

THE PREMISE IS OBVIOUSLY FALSE

If we can easily see a premise is false, we can simply deem it unacceptable.

eg "the dog is a cat."

INCONSISTENT PREMISES

1. We say a set of claims is inconsistent if it is logically impossible for them all to be true at once. (A single claim is inconsistent if it is impossible for it to be true.)

eg "all humans are carnivorous" and "some humans are vegetarians". } they contradict each other!

2. Since the premises cannot all be true at once, we must have that one or more of the premises are unacceptable.

PREMISE IS TOO VAGUE

If we cannot understand what a sentence says (due to the sentence's fault), it will not be rational for us to accept it.

(of course, we can always ask the person to clarify if in doubt.)

PREMISE IS CONTROVERSIAL / PRESUPPOSES SOMETHING CONTROVERSIAL

If a premise is controversial, or relies upon something controversial, there is sufficient reason for us to reject it.

eg (Nobody should undertake university education without at least some idea of what she wants to do and where she wants to go in life.) But our world is so full of change that we cannot predict which fields will provide job openings in the future. Given this, we cannot form any reasonable life plans. So nobody should go to university.

→ this premise presupposes we go to university to get job training!

↳ however, this is controversial! (So we have grounds to reject it, if no supporting arguments are available.)

BEGGING THE QUESTION / CIRCULAR ARGUMENT

"Begging the question" occurs when, in order to find a premise acceptable, we need to already consider the conclusion to be acceptable.

* Observe any "circular" arguments cannot function as a conventional argument — that is, to use premises to convince others that the conclusion is right. But in a circular argument, others have already been convinced the conclusion is true!

*note: this is an example of a sound argument not being a cogent argument!

eg "A, therefore A" is sound, but fails the "A" condition! (So it is not cogent.)

RELEVANCE

WHAT ACTUALLY IS RELEVANCE?

POSITIVE / NEGATIVE RELEVANCE

1. We say a premise is "positively relevant" to a conclusion when, if it were true, it would support it.

note: we will assume "positive relevance" when we refer to relevance.

2. Similarly, a premise is "negatively relevant" to a conclusion if it counts against the truth of the conclusion if it were true.

3. Lastly, a premise is "irrelevant" if it is neither positively nor negatively relevant.

4. Note that:
   1. Relevance only needs to be raised if the argument is not valid.
   2. If a premise is irrelevant, its acceptability does not matter.
      → if ALL the premises are irrelevant, the argument is dead.

ADDING PREMISES TO FIX IRRELEVANCE

1. We can add unstated premises to an argument to try to make some of its premises relevant.

eg "you shouldn't be surprised the basketball hit him. He's a philosopher".
↳ at first, the 2 premises seem not at all related. However, if we add the missing premise "philosophers are uncoordinated", then the argument starts to make sense.

2. Note that we should only add missing premises if we have ample reason to think the arguer would accept them.

why? This arises from the principle of charity: If we add an outlandish missing premise onto an argument, we either admit the arguer fails to recognise the irrelevance of their premises, or he/she has an outlandish belief which links the offending premise to the conclusion.

FALLACIES OF IRRELEVANCE

RED HERRING

1. A red herring fallacy occurs when an arguer starts to debate about an irrelevant issue, which is not related to the original topic.

eg a politician saying how they feel about a related topic, and not addressing the original question they were asked.

2. Note that this is an example of a "diversionary fallacy", as it attempts to "divert" the debate away from the issue at hand.

STRAW MAN

1. A straw man fallacy occurs when:
   1. the arguer is trying to refute another person's view on some issue; then,
   2. they misinterpret their stance on said issue, and attribute a view other than the one held by that person; and lastly,
   3. they "refute" this new position by attacking this view, which is not the one the person held in the first place.

eg A: "abortion should be illegal where it is a matter of convenience for a woman to not have a child."

B: "you can't ban abortion because that would result in misery for victims of rape & incest!"

notice that the arguer does not refute A's original viewpoint, and so has committed the straw man fallacy.

2. It clearly follows that any subsequent argument made is irrelevant, as it does not pertain to the other person's view.

* note: this fallacy often occurs in emotional settings, especially when the issue at hand is something the arguer has a deep connection with.

AD HOMINEM

1. An ad hominem fallacy occurs when an arguer attacks a person directly, instead of arguing against the claims that person has put forward.

eg "I wouldn't believe what he says about free trade. He's a convicted wife-beater."

* note: sometimes, a person's character traits are relevant to the argument, and so might be considered acceptable. (But these are special cases!)

GUILT BY ASSOCIATION

1. An arguer commits a "guilt by association" fallacy when they allude to the fact that their opponent's position is linked to another group, which often is associated with negative connotations.

eg "don't listen to what he says; that's exactly what the Communists did in 1917"
↳ the arguer is associating the other person's point with the Communists, which we may disapprove of.

* note: an ad hominem fallacy attacks the person behind the argument; a guilt by association fallacy attacks the position behind the argument.

Chapter 4: Formal Logic

BASIC CONCEPTS OF LOGIC

CONSISTENCY

1. A group of statements is consistent if all the statements in the group could be true at once.

*note: we usually use "{ , }" to group sentences together;
eg "{Bob is bald, Bob has lots of hair.}"

*note the "could" in the defⁿ; a consistent set of sentences is not necessarily true, it must just be possible for them to all be true simultaneously.

LOGICAL TRUTH (TAUTOLOGY)

1. A statement is logically true if and only if it is impossible for that sentence to be false.
(we also call such sentences "tautologies".)

2. Similarly, a statement is logically false if and only if it is impossible for that sentence to be true.

CONTINGENCY

If a sentence is neither logically true or false, we call them "contingent".

LOGICAL EQUIVALENCE

Two statements are logically equivalent if it is impossible for them to have different truth values.

HOW IS LOGIC USEFUL?

1. Logic can be used to determine whether an argument is valid; ie whether the premises imply the conclusion.

2. However, it cannot be used to determine whether an argument is cogent, since it cannot tell us whether the premises satisfy the "A" condition (unless they are logically true / false.)

SENTENTIAL LOGIC / LANGUAGE (SL)

Sentential logic is a method of expressing arguments in a symbolic form, so they are easier to comprehend.

SENTENTIAL VARIABLES

Sentential variables are placeholders for simple declarative sentences. (we often use capital letters for this.)

eg "He is tall, but dumb".
Therefore
"He is dumb" ⇒ A, but B.
Therefore
B.

AND (&)

The symbol "&" is a connective that can link two sentences together, and has the same meaning as "and".

ie "A & B" is the same as "A and B".

* there are other words logically equivalent to &:
eg although, but, however, etc.

(INCLUSIVE) OR (v)

Similarly, "v" is also a connective, and has the same meaning as "or".

ie "A v B" is the same as "either A or B".

NOT (¬)

"¬" is often referred to as a "negation symbol", and has the same meaning as "not".

ie "¬A" is the same as "not A" or "it is not the case that A".

IMPLIES (⇒)

"⇒" is referred to as the "implication symbol", and has the same meaning as "implies".

ie (A ⇒ B) is the same as "A implies B".

*A is known as the antecedent, and B the consequent.

USING BRACKETS

We can use brackets to connect groups of three or more sentences.

eg (A & B) & C
(A & B) ⇒ C
A & (B ⇒ C)

*notice that order of the brackets matters: these 2 statements do not mean the same thing!

CONVERTING ENGLISH INTO SL

We can convert any argument into SL via the following:
We can convert any argument into SL via the following; we can denote each premise;

1. Denote a distinct sentential variable to each premise;
2. Convert all the connectives into symbolic form;
3. Rewrite the argument using these symbols.

Eg

Example: If physics is easier than math, then if John can do math he can do physics. If John has no sense for the fit between abstract principles and the physical world, he won't be able to do physics. John can do math, but he has no sense for the fit between abstract principles and the physical world. Physics, therefore, is not easier than math.

① E: Physics is easier than math.
M: John can do Math.
P: John can do Physics.
S: John has a sense between abstract principles and the physical world.

list out which letters correspond to which premises.

②,③
1. E ⇒ (M ⇒ P)
2. ¬S ⇒ ¬P.
3. M & ¬S.
Therefore,
4. ¬E.

PROOFS

We can also use SL to prove whether an argument is valid or not.

Format:

① We list all the premises with numbers, and write "premise" beside it (this is our justification.)

② From here, we can use our rules to prove the conclusion.

eg

1. A & B — Premise
2. C — Premise

⋮] - here we would write our justifications.

n. A & C

RULES OF INFERENCE

& ELIMINATION

The rule of "& elimination" states that
A & B is true ⇒ A is true and B is true.

ie we would write

n. A & B — premise number.

A — ⋮ n, & elimination] this is our "justification" for this step.

this is the premise number for which we applied our rule.

& INTRODUCTION

The rule of "& introduction" states that
A is true and B is true ⇒ A & B is true.

ie we would write

m. A ⋮ — premise numbers

n. B ⋮

A & B — m, n & introduction.

*note how the justification is formatted.

MODUS PONENS

The rule of "modus ponens" states that
if A ⇒ B is true, and A is true, then B is true.

ie we would write

m. A ⇒ B

n. A

B — m, n modus ponens

SUPPOSITION & CONDITIONAL PROOF (PROVING ⇒)

When proving statements involving "⇒", we often want to prove that if we assume the antecedent is true, then the consequent is also true.

When we make a supposition (assumption), we indent it and all the lines which depend on it in our proof.

Then, once we have showed our result holds for the assumption, we can write our result as being conditionally proved.

eg

m. ⋮ A — assumption

*notice how this step and all the others that rely on it are indented!

⋮

n. B

A ⇒ B — m-n, conditional proof

this is what we write when we have proved a conditional result.

REDUCTIO AD ABSURDUM

A "reductio ad absurdum" proof relies on proving that if a statement was true, it leads to a contradiction (ie it proves something must be simultaneously true & false.)

eg

m. ⋮ A — assumption

⋮

B

⋮

¬B

notice if we assume A is true, B & ¬B are simultaneously true, and so A must be false.

o. ¬A — m-o, reductio.

notice the format!

FUNDAMENTAL SIMPLIFYING ASSUMPTION OF CLASSICAL LOGIC

FSAOCL states that every sentence is either true or false.

CONSTRUCTIVE DILEMMA

The rule of "constructive dilemma" states that
if A ⇒ C and B ⇒ C, then (A ∨ B) ⇒ C.

eg

m. A ∨ B

n. A — assumption } assumption 1: we prove A ⇒ C.

⋯

o. C

p. B — assumption } assumption 2: we prove B ⇒ C.

⋯

q. C

r. C — m, n-o, p-q constructive dilemma

REPETITION

The rule of "repetition" simply states that
if we know A is true, we can restate A is true.

ie m. A

n. A — m, repetition

∨-INTRODUCTION

The rule of "∨-introduction" states that
if A is true, then A ∨ B is true for any statement B.

ie m. A

n. A ∨ B — m, ∨-introduction

DOUBLE NEGATION / ¬¬ - ELIMINATION

The rule of "¬¬-elimination" states that
if A is true, then ¬(¬A) is also true.

ie n. ¬¬A

o. A — m, ¬¬-elimination.

DISJUNCTIVE SYLLOGISM (EXAMPLE)

Disjunctive syllogism states that
if A ∨ B is true, and ¬B is true, then A is true.

We can prove this using SL:

1. A ∨ B — Premise
2. ¬B — Premise
3. A — Assumption
4. A — 3, repetition
5. B — Assumption
6. ¬A — Assumption
7. B — 5, repetition
8. ¬B — 2, repetition
9. ¬¬A — 6-8, reductio
10. A — 9, ¬¬-elimination
11. A — 1, 3-4, 5-10 constructive dilemma.

PROVING INVALIDITY

1. A "counterexample" for an argument is a case in which all of its premises are true, but the conclusion is false.
2. Then, an argument is valid iff it has no counterexamples.
3. So, to show that an argument is invalid, we need to find a counterexample to it.

METHOD (AKA "DEAD RECKONING")

1. First, note the characteristic truth table for &, ∨, ⇒ and ¬:

A	B	¬A	A & B	A ⇒ B	A ∨ B
T	T	F	T	T	T
T	F	F	F	F	T
F	T	T	F	T	T
F	F	T	F	T	F

2. Then, list all the premises & conclusion across the page. Write a "T" under the "main operator" of each premise, and a "F" under the "main operator" of the conclusion.
(write a "1" above each main operator too.)

eg $\quad P \overset{1}{\underset{T}{\Rightarrow}} Q \qquad Q \overset{1}{\underset{T}{\Rightarrow}} R \qquad R \overset{1}{\underset{F}{\Rightarrow}} S$

3. Subsequently, look at the truth table for the operator. Find the truth values of its "constituent" statements that make it have the truth value that it does, and fill in the truth values for these statements.

eg cont. $\quad \overset{2}{\underset{T}{P}} \overset{1}{\underset{T}{\Rightarrow}} Q \qquad Q \overset{1}{\underset{T}{\Rightarrow}} \overset{2}{\underset{F}{R}} \qquad \overset{2}{\underset{T}{P}} \overset{1}{\underset{F}{\Rightarrow}} \overset{2}{\underset{F}{R}}$

* note since this is the same "case", the sentence letters have the same truth value.

4. Repeat the previous step until:
   ① all the truth values have been filled; or → argument is invalid! (since a counterexample exists)
   ② something must be simultaneously true & false. → argument is valid. (no counterexample can exist.)

eg cont. 2 $\quad \overset{2}{\underset{T}{P}} \overset{1}{\underset{T}{\Rightarrow}} \overset{3}{\underset{T}{Q}} \qquad \overset{3}{\underset{T/F}{Q}} \overset{1}{\underset{T}{\Rightarrow}} \overset{2}{\underset{F}{R}} \qquad \overset{2}{\underset{T}{P}} \overset{1}{\underset{F}{\Rightarrow}} \overset{2}{\underset{F}{R}}$

Q must be simultaneously true & false! Hence no counterexample can exist, proving the argument is valid.

eg² $\quad \overset{3}{\underset{F}{Q}} \overset{1}{\underset{T}{\vee}} \overset{2}{\underset{F}{R}} \qquad \overset{2}{\underset{F}{P}} \overset{1}{\underset{T}{\Rightarrow}} \overset{3}{\underset{F}{Q}} \qquad \overset{2}{\underset{F}{P}} \overset{1}{\underset{F}{\vee}} \overset{2}{\underset{F}{R}}$

* Since there are no contradictions, this is a counterexample to the argument; hence this argument is invalid.

5. Note: if we reach a point where we are not forced to assign any particular value to any particular sentence in an argument, we have to "split" our reasoning and consider 2 different cases:

eg $\quad \overset{2}{\underset{F}{P}} \overset{1}{\underset{T}{\Rightarrow}} Q \qquad Q \overset{1}{\underset{T}{\Rightarrow}} S \qquad \overset{2}{\underset{F}{P}} \overset{1}{\underset{F}{\vee}} \overset{2}{\underset{F}{R}}$ — notice we are not "forced" to assign any truth value to Q!

From here, we split (and evaluate each case):

$\overset{2}{\underset{F}{P}} \overset{1}{\underset{T}{\Rightarrow}} \overset{3}{\underset{T}{Q}} \qquad \overset{3}{\underset{T}{Q}} \overset{1}{\underset{T}{\Rightarrow}} \overset{4}{\underset{T}{S}} \qquad \overset{2}{\underset{F}{P}} \overset{1}{\underset{F}{\vee}} \overset{2}{\underset{F}{R}}$ — valid counterexample (so the argument is invalid.)

$\overset{2}{\underset{F}{P}} \overset{1}{\underset{T}{\Rightarrow}} \overset{3}{\underset{F}{Q}} \qquad \overset{3}{\underset{F}{Q}} \overset{1}{\underset{T}{\Rightarrow}} \overset{4}{\underset{T\text{ or }F}{S}} \qquad \overset{2}{\underset{F}{P}} \overset{1}{\underset{F}{\vee}} \overset{2}{\underset{F}{R}}$

PREDICATE LOGIC

Predicate logic is a more powerful system of logic than SL.

TERMINOLOGY

SINGULAR TERM

1. A "singular term" refers to a particular object.

eg my dog, Dave, etc.

PREDICATE

1. A "predicate" is what results when we begin with a declarative sentence, and replace one (or more) occurrences of one singular term by blanks.

eg "Dave is tall" → "... is tall".

original declarative sentence — predicate (notice the blank).

2. If a particular singular term makes a predicate true, we say that term satisfies that predicate.

TOOLS OF PL

REPRESENTING PREDICATES

1. Instead of using "..." to indicate a blank in a predicate, we use variables; in particular, we use small italic letters.

eg x, y, z, w, etc.

2. Similarly, we use a capital italic letter to stand for the predicate itself, and we follow it by the variable indicating the blank.

eg Px, Ty, Az, ..

predicate — variable

LOGICAL CONNECTIVES

We use all of the same logical connectives as SL, and we have to specify meanings for the formal predicates & singular terms we have to use.

eg
b: Barb → specify variable
Tx: x is tall
Cx: x is a cop } → specify predicates

$Cb \Rightarrow Tb$] → "$\Rightarrow$" has the same meaning as SL; ie if Barb is a cop, then Barb is tall.

QUANTIFIERS ($\exists$, $\forall$)

1. $(\exists x)\, Px$ means "there is at least one x for which Px is true".
2. $(\forall x)\, Px$ means "for any x, Px is true".

UNIVERSE OF DISCOURSE (UD)

When using quantifiers, we need to specify what they are referring to; we call this the "universe of discourse", or UD.

ie we might say "UD = people".

SCOPE

The scope of a quantifier is the "part" of the formula which the quantifier expression applies to.

eg
1) $(\forall x) Px$ — scope is $(\forall x) Px$
2) $(\exists x) Px \vee Qx$ — scope is $(\exists x) Px$.

NEGATION OF QUANTIFIERS

Note that:

① $\neg(\exists x) Px \iff (\forall x) \neg Px$; and

there does not exist an x such that Px is true — for all x, Px is not true

② $\neg(\forall x) Px \iff (\exists x) \neg Px$.

it is not true that Px is true for all x — Px is not true for at least one value of x.

CATEGORICAL REASONING

UNIVERSAL AFFIRMATIONS

An "universal affirmation" is a claim of the form "every ... that is ... is also ...".

eg UD = everything
Rx : x is a rose
Sx : x smells sweet
definitions

$(\forall x)(Rx \Rightarrow Sx)$ ie for any thing, if it is a rose, it is also sweet.

UNIVERSAL DENIALS / NEGATIVES

An "universal denial" is a claim of the form "every ... that is ... is not ...".

eg UD = everything
Rx : x is a rose
Bx : x smells bad

$(\forall x)(Rx \Rightarrow \neg Bx)$

*note: this is equivalent to $\neg(\exists x)(Rx \& Bx)$!

PARTICULAR AFFIRMATIONS

A "particular affirmation" is a claim of the form "there is at least one ... such that ... and ...".

eg UD = everything
Cx : x is a cougar
Wx : x is white
definitions

$(\exists x)(Cx \& Wx)$. ie there exists an x for which Cx and Wx are both true.

PARTICULAR NEGATIVES

A "particular negative" is a claim of the form "there is at least one ... such that ... but not ...".

eg UD = animals
Dx : x is a dog
Bx : x is brown
definitions

$(\exists x)(Dx \& \neg Bx)$ ie there exists an x for which Dx is true, but not Bx.

THE SQUARE OF OPPOSITION

The "square of opposition" is a method of visualising the 4 types of statements in categorical logic.

A universal affirmations $(\forall x)(Xx \Rightarrow Yx)$

E universal denials $(\forall x)(Xx \Rightarrow \neg Yx)$ or $\neg(\exists x)(Xx \& Yx)$

E and I are negatives of each other.

A and O are negatives of each other.

I particular affirmations $(\exists x)(Xx \& Yx)$

O particular denials $\neg(\forall x)(Xx \Rightarrow Yx)$ or $(\exists x)(Xx \& \neg Yx)$

CONTRARIES

1. Two statements are contraries if they cannot be true at the same time, but can be false at the same time.

eg "all men are bald" and "all men are not bald".

2. Note that if a statement is in the form of "A", and another is in the form of "E", then they are contraries of each other.

SUB-CONTRARIES

1. Two statements are sub-contraries if they can be true at the same time, but cannot both be false.

eg "at least one man is handsome and bald" and "at least one man is handsome and not bald".

2. Similarly, if a statement is of the form of "I" and another is of the form of "O", then they are sub-contraries.

*exception: if no "x" exist (which means they would be contraries instead.)

INFERENCE RULES FOR PL

EQUIVALENCE BETWEEN ∃ AND ∀

We can use the justifications of
① $(\exists x)\neg[\dots]$ equivalent to $\neg(\forall x)[\dots]$ and
② $\neg(\exists x)[\dots]$ equivalent to $(\forall x)\neg[\dots]$
in our proofs to switch between ∃ and ∀.

EXISTENTIAL GENERALISATION

The rule of "existential generalisation" simply states if Pd is true, then there exists an x for which Px is true.

ie
n. Pd
$(\exists x)Px$ n, existential generalisation

UNIVERSAL INSTANTIATION

The rule of "universal instantiation" simply states if Px is true for all x, then Pd is true.

ie
n. $(\forall x)Px$
Pd n, universal instantiation

SHOWING INVALIDITY

To show an argument in PL is invalid, we need to come up with a "counterexample" with an UD and predicates such that the premises are true and the conclusion is false.

eg
1. $(\forall x)(Mx \Rightarrow Bx)$
2. $(\forall x)(Kx \Rightarrow Bx)$
Therefore,
3. $(\exists x)(Kx \& Mx)$.

A counterexample would be
UD = integers
Mx : x is odd
Kx : x is even
Bx : x is a number.

Chapter 5: Induction and Scientific Reasoning

CORRELATIONS

A "correlation" is any claim that asserts that there exists a specific numerical relationship between two (or more) variables.

eg "married men are more likely than unmarried men to live past age 70".

TERMINOLOGY

POPULATION

For any given correlation, the "population" is the group among which the correlation exists.

VARIABLE + VALUE

1. A "variable" is a general property which all members of the population must have.

2. Moreover, each variable must have at least two different "values".

eg Variable: marital status
Values: married or unmarried.

3. Additionally, the values of the variables must be both
   1. exclusive; &
      - ie no 2 members of the popⁿ have more than one value
   2. exhaustive.
      - ie every member of the popⁿ has one value for each variable.

PROPORTION

For a given property, the "proportion" of the population with said property is given by the formula

$$\text{proportion} = \frac{\#\text{ of members in pop}^{\underline{n}}\text{ with the property}}{\#\text{ of members in pop}^{\underline{n}}}.$$

*proportions are often expressed as percentages.

SUBPOPULATION

A "subpopulation" is a part of the original population which takes some particular value of one of the variables.

eg the subpopulation of married men.

POSITIVELY CORRELATED

We say that two values X & A of 2 different variables are "positively correlated" when the proportion of the subpopulation with X that has A is greater than the proportion of the subpopulation without X that has A;

ie $P(x=X \mid a=A) > P(x \neq X \mid a=A)$.

prop. of popⁿ with x=X which also has a=A

prop. of popⁿ w/o x=X which also has a=A.

NEGATIVELY CORRELATED

Similarly, two values X & A of 2 different variables are "negatively correlated" if $P(x=X \mid a=A) < P(x \neq X \mid a=A)$.

UNCORRELATED

Lastly, two values X & A of 2 different variables are "uncorrelated" if $P(x=X \mid a=A) = P(x \neq X \mid a=A)$.

SAMPLES

A "sample" is a smaller, manageable version of a larger group that (in theory) contains the same characteristics as its parent population.

TRIAL

A "trial" is when we select a member of the population and add it to our sample.

RANDOMNESS

1. A sample is "random" if every member of the population has an equal chance of being selected on each trial.

2. Randomness is desirable because it allows us to draw conclusions about the population with a fair degree of confidence.

FREQUENCY

The "frequency" of a value of a variable is defined to be

$$\text{freq} = \frac{\#\text{ of observations of the value}}{\#\text{ of trials}}.$$

SIZE OF SAMPLES

Larger samples are better than smaller samples because we can make inferences about the population with a smaller margin of error if the sample is large.

MARGIN OF ERROR

1. The "margin of error" of a sample is such that 95% of the time, the distribution of a property in a popⁿ will be in the range of the observed frequency ± the margin of error.

2. Common margins of error for various sample sizes:
   - 25 trials ⟺ 25%
   - 100 trials ⟺ 10%
   - 500 trials ⟺ 5%
   - 2000 trials ⟺ 2%
   - 10000 trials ⟺ 1%

STATISTICALLY SIGNIFICANT

A correlation is "statistically significant" if the "ranges" of each value of a variable (ie observed frequency ± margin of error) do not overlap with one another.

COMMON STATISTICAL ARGUMENTS

SIMPLE STATISTICAL CLAIMS

Simple statistical claims are arguments of the form

1. In sample S, property P was observed with frequency f.
2. Sample S is (probably) representative of population W.

Therefore,

3. The proportion of P in W is (probably) f ± ME.

CLAIMS ABOUT CORRELATIONS

Claims about correlations are arguments of the form

1. In sample S, the observed frequency of P among Xs is f, whilst among non-Xs it is g.
2. Sample S is (probably) representative of population W.

Therefore,

3. P is (probably) [+vely/-vely/not] correlated with being an X in population W.

BIAS

1. A "biased" sample is a sample that demonstrably and obviously misrepresents the population.
2. A biased sample will make the conclusions drawn from it not applicable to the general population, and hence any argument referencing them will be unacceptable.

STRATIFIED SAMPLING

A "stratified sample" is a sample selected in such a way that significant characteristics within the population are (approximately) proportionally represented within it.

CAUSAL CLAIMS

A causal claim is any assertion that there exists a relationship between two events such that one is the effect of the other.

ie a claim of the type
"if x happened, then y would happen, all other things being equal."

CAUSAL FACTORS

1. For any given effect E of a population P, a "causal factor" C for E is a characteristic of P which is thought to directly influence whether a member of P has E or not.
2. A causal factor C of an effect E is "positive" if having C increases the chances that a member of the population has E;
   eg smoking causes lung cancer.
3. Similarly, a causal factor C of an effect E is "negative" if having C decreases the chances that a member of the population has E;
   eg contraceptives prevents pregnancies.

* note: any given effect might have more than one causal factors!

EVIDENCE FOR CAUSAL CLAIMS

METHOD

1. Suppose we want to test whether one thing "C" causes something else "E" in a population P.
   eg C = high fat diet
   E = breast cancer
   P = women.
2. Then, we want to produce 2 samples of P such that the only relevant difference between the samples is that
   ① all the members of the first "experimental" group X have C; and
   ② all the members of the second "control" group K do not have C.
3. Then, if there is a statistically significant difference in the proportions of X and K that have E, it suggests that C is a causal factor for E.

STRENGTH OF CAUSAL FACTORS

We can determine the "strength" of a causal factor by the relative "distances" between the confidence intervals
(ie the observed frequency ± margin of error)
of the proportion of X that had E and the proportion of K that had E.

* the larger the distance, the stronger the causal factor.

THINGS THAT COULD GO WRONG

There are several potential flaws that such an experiment might have:

① X and/or K might not be representative of the population at large;
② there might be other relevant differences between X and K besides whether they have C or not; or
③ the observed difference might not be statistically significant.

DIFFERENT SORTS OF EXPERIMENTS

RANDOMISED

In a randomised experimental design, X and K are randomly selected from the population P.

Then, C is "imposed" on X and "prevented" in K.

PROSPECTIVE

In prospective experiments, we select X from the proportion of the population that has C, and K from the proportion of the population without C.

Potential flaws:
1. Sampling might not be random;
2. There might be other relevant factors that most members of a group share and the other do not;

So, to make the sampling as random as possible, we might try to "approximate" the random selection; ie we would attempt to "control for variables".

RETROSPECTIVE

In a retrospective study, the X group is selected from the population who has E, and K from the population who do not have E.

Then, we see the proportion of each of these groups that have C.
If more people from X have C, then we have evidence that C is a causal factor for E.

* we need to ensure that all other "factors" between X and K are the same; ie that the only difference between them is that one has E, and the another does not.

*again, we need to control our variables.

**note: randomised studies are the strongest, followed by prospective, and then retrospective.

EVALUATING CAUSAL HYPOTHESES

When evaluating any study which attempts to establish a causal relationship, go through these steps:

1. Find the key parts of the study; ie C, E, X, K, P, and the experimental design.
2. If the study was randomised:
   - i) was the experiment conducted on non-human animals?
     - a further argument is needed before conclusions can be drawn
   - ii) was the sampling process for X & K sufficiently randomised?
   - iii) did the process for introducing C into X but not K create other relevant differences between the groups?
3. If the study was prospective or retrospective:
   - i) were there any other relevant variables that might explain away the results observed in the study?
   - ii) were such variables controlled for?

SPECIAL PROBLEMS IN THE SOCIAL SCIENCES

OPERATIONALISATION

1 "Operationalisation" is the process in which a non-measurable everyday concept is "compared" to and "measured by" a measureable and precise analogue.

eg "intelligence" is typically operationalised by scores of an IQ test.

2 However, the operationalised term might not reflect the full "story" of the original term, which can lead to misleading conclusions.

eg IQ only measures one factor of intelligence.

SOCIAL SCIENCE IS NOT JUST ABOUT "THE FACTS"

FUNDING AGENCIES

1 The issue studied might reflect values held by agencies responsible for the funding of the study.

2 Hence, the study methods might be altered to reflect these values.

* the interests might be economic or political.

PERSONAL VALUES

In some instances, a scientist might have personal values that lead them to either

i) define an issue a special way; or

ii) look for certain facts and not others.

eg a scientist's ethical views

THEORETICAL "COMMITMENTS"

Sometimes, a scientist might have made certain "theoretical commitments" that might shape their view of what facts are "significant", and then warp the interpretation of said facts.

eg if a scientist has a certain "perspective" throughout their research.

PROBLEMS WITH QUESTIONNAIRES, POLLS & INTERVIEWS

QUESTIONS ARE NOT PROPERLY FRAMED

Conclusions drawn from a questionnaire/poll/interview might be unreliable if the questions are not properly framed.

eg if the questions are ambiguous.

QUESTIONS ARE FRAMED TO ELICIT A CERTAIN RESPONSE

In other instances, the questions might be written to invoke a certain response.

eg emotional language, order of questions.

MANIPULATION OF SOCIAL SCIENCE RESEARCH

PERSUASIVE DEFINITION BY OPERATIONALISATION

A persuasive definition can arise if an operationalisation of a term is used to make a misleading/false claim about the term itself.

CAREFUL SELECTION OF FACTS

In other instances, a "fact" might be hiding another less flattering fact.

FACTS MAY ACQUIRE A "LIFE" OF THEIR OWN

Sometimes, a fact with no evidence, or has already been debunked, might acquire a life of its own; ie be popularised and spread.

eg the measles vaccine gives AIDS.

Chapter 6: Other Types of Arguments

ARGUMENTS BY ANALOGY

STRUCTURE

In an argument by analogy, there are two main subjects at play:

① The "primary subject"; ie the subject we are concerned with in the argument; and
eg the structure of an atom

② The "analogue"; ie a subject that is better known/understood than the primary subject, which we use to compare the primary subject to.
eg a "mini solar system".

Then, the basic structure of these arguments is as follows:

1. The analogue has features $X_1, X_2, \ldots, X_n$;
2. The primary subject also has features $X_1, X_2, \ldots, X_n$;
3. The analogue also has feature Z;
4. The features $X_1, X_2, \ldots, X_n$ are relevant to being able to infer that the analogue and the primary subject can also be expected to be similar with respect to Z, and they are sufficient to show that we can expect it.

Therefore,

5. The primary subject is also likely to have feature Z.

WHY AN ARGUMENT BY ANALOGY MIGHT BE INVALID

ANALOGUE AND PRIMARY SUBJECT DO NOT SHARE COMMON FEATURES

An argument by analogy might fail if the analogue and primary subject do not share common features with one another.

One way this might occur is by equivocation.
eg "my spouse is like a loaded pistol when she's drunk".

THERE ARE RELEVANT DIFFERENCES BETWEEN THE PRIMARY SUBJECT AND ANALOGUE

An argument by analogy might also fail if there are relevant differences between the primary subject and analogue that the arguer has failed to take into account.

THE SIMILARITIES BETWEEN THE PRIMARY SUBJECT & ANALOGUE ARE IRRELEVANT / NOT SUFFICIENT GROUNDS TO SUSPECT THE PRIMARY SUBJECT HAS Z

Another reason an argument by analogy might fail is if the listed similarities between the primary subject and the analogue are irrelevant, or do not provide sufficient evidence that the primary subject has another characteristic that the analogue has.

INDUCTIVE ANALOGY

An "inductive analogy" is a special form of an argument by analogy where the analogue is something in real life, and revolves around the factual similarities between the analogue and primary subject.

eg relating the effects of certain substances on animals (eg mice) to the effects of these substances on humans.

Note that an inductive analogy may be flawed if it is "faulty"; ie it does not "match" the structure of an argument by analogy.

CONSISTENCY ANALOGY

A "consistency analogy" is another special form of an argument by analogy where the arguer lists the similarities between the primary subject and the analogue, and uses said similarities to claim that these cases should be regarded as alike with respect to the to-be-inferred characteristic Z (and so suggests the analogue has Z.)

eg "he got a bigger piece of pie than me! That's not fair — I'm your son, too."
→ unstated conclusion: parent ought to give an equal piece of pie to all of their children.

Potential flaws with consistency arguments:

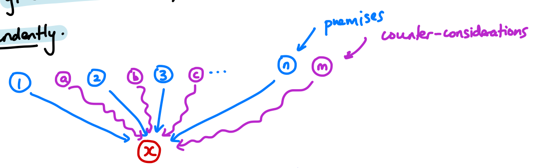
① Faulty analogy
- ie does not follow the structure of an argument by analogy

② "Two wrongs" fallacy
- the arguer presumes we treat the analogue and primary subject inconsistently

③ "Slippery precedent" fallacy
- arguer says something along the lines of "I should do X for this person, because their claim is justified, but if I do it will set a precedent so that many others without justified claims will be pounding down my door expecting me to do X too!"
- fallacy: if you treat two cases differently, they are relevantly dissimilar, and so there is no obligation to treat them similarly.

CONDUCTIVE ARGUMENTS

1. A "conductive argument" is an argument whose premises are "convergent"; ie they give evidence for the conclusion independently.



* the premises all imply the conclusion by themselves!

2. Note that often a conductive argument will include many counter-considerations towards the conclusion; however, we can always construct our argument to show the pro-considerations "outweighs" the counter-considerations.

EVALUATING A CONDUCTIVE ARGUMENT

Here are the steps / strategies we can use when analysing and evaluating conductive arguments.

1. Work out whether each premise, by itself, is acceptable and relevant to the argument.
2. We also want to ensure each premise supports the conclusion.
3. Similarly, we want to make sure each counter-consideration is acceptable and relevant, as well as provides evidence against the conclusion.
4. After we have filtered out all the "good" points from the bad, we now need to "weigh" the remaining proposed good reasons for the conclusion against the counterconsiderations.
5. There are several ways to do this:
   - i) Some considerations might be "decisive"; ie they outweigh the other points significantly. In this case, we can conclude the side with these decisive considerations "wins" the argument, and we are done.
   - ii) We could also order the considerations in terms of priority / weight, and this might help us in our analysis.
   - iii) Additionally, we must also consider that there may be other relevant considerations that the arguer has not thought about that might change the balance of considerations significantly.