

Recall

- Validity:
 - If the premises are true the conclusion must be true
- Soundness
 - Valid; and
 - Premises are true

Validity

- In order to determine if an argument is valid, we must evaluate all of the sets of truth values (interpretations) that an argument can have.
- This can be quite difficult.
- Logicians have devised many tools for establishing validity using a variety of shortcuts.
- In contrast, establishing invalidity is quite simple: all you need to do is to provide one counter example (the Method of Counter Example).

Valid forms

- *Modus Ponens*

If A then B

A

Therefore B

- *Modus Tollens*

If A then B

\neg B

Therefore \neg A

Conditional truth table

- Truth table for 'A→B' i.e. If A then B
- We can verify both MP and MT.

A	B	A→B	~A	~B
T	T			
T	F			
F	T			
F	F			

Note: $A \rightarrow B = \sim A \text{ or } B$.

Examples of 'if...then'

- Equivalent to $S \rightarrow B$:
- If you're smart then you're beautiful.
- If you're smart, you're beautiful.
- You're beautiful if you're smart.
- You're smart only if you're beautiful.

Valid forms (cont.)

Disjunctive syllogism

A or B

not A

Therefore B

MP Equivalence

$A \rightarrow B$ (i.e. $\sim A \vee B$)

A (i.e., not not A)

Therefore B

Valid forms (cont.)

Hypothetical syllogism

A \rightarrow B

B \rightarrow C

Therefore A \rightarrow C

Two MP applications

if A then B

if B then C

A (hypothesis, i.e., 'if')

B

C

Therefore, if A then C

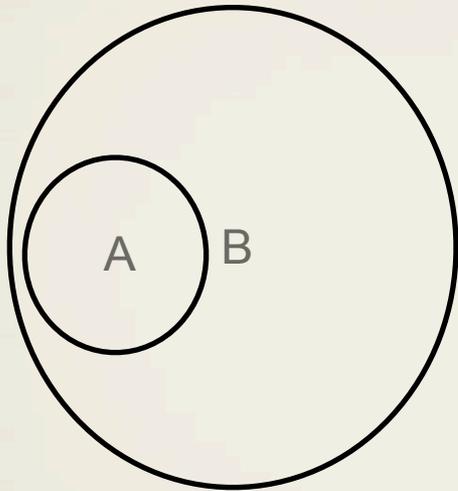
Quantifiers

- Quantifiers are 'all' or 'some' in a sentence
- MP applies for 'all' but not 'some'

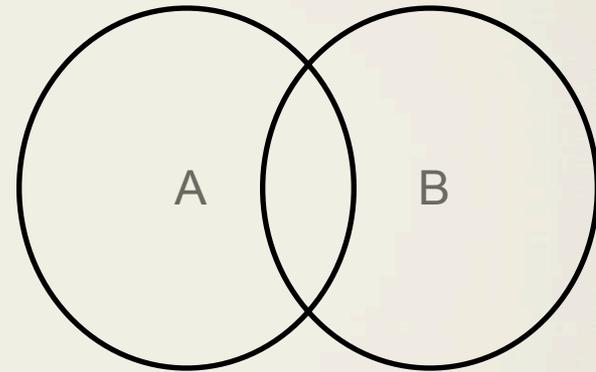
Example:

- 'Some dogs are black'
- 'Some black things are bigger than earth'
- 'Therefore some dogs are bigger than earth' (invalid)
- Instead, use Venn diagrams

Venn diagrams



All A are B



Some A are B

Etc... (No A are B; i is B; No C is A and B)

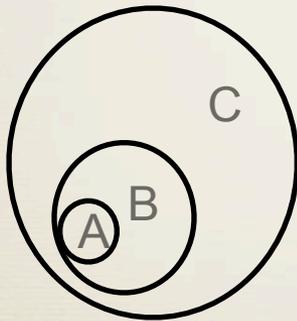
Valid forms (cont.)

Universal syllogism

All A are B

All B are C

So All A are C



All A are B

All B are C

So, All A are C

Two MP applications

All A are B = $(x)Ax \rightarrow Bx$

All B are C

Ax (hypothesis, i.e., 'if')

Bx

Cx

Therefore, All A are C

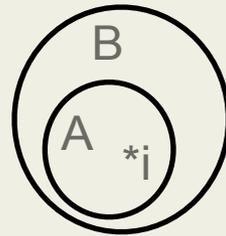
Valid forms (cont.)

Universal-particular syllogisms

All A are B

Individual i is A

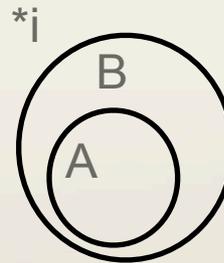
Therefore, i is B



All A are B

Individual i is non-B

Therefore, i is non-A



Modus Ponens

$(x)Ax \rightarrow Bx$

Ai

Therefore Bi

Modus Tollens

$(x)Ax \rightarrow Bx$

$\sim Bi$

Therefore $\sim Ai$

(Note: 'non' is often not the same as 'not' e.g. non-friendly versus not friendly).

Summary

- There is no point in trying to memorize all of the possible valid argument forms. There are an infinite variety.
- Nevertheless, the ones above are by far the most common.
- The power of formal logic lies in its ability to systematically organize valid argument forms (e.g., seeing how they are all versions of MP).

Invalid arguments

- To show an argument is invalid, you can:
 - describe a situation in which the premises are true and the conclusion is false; or
 - show that the argument fits a typical form of invalid argument

- For instance...

Invalid forms

*Affirming the
consequent*

If A then B

B

Therefore A

Example of affirming the consequent

If I punch you in the nose it bleeds.

Your nose is bleeding.

Therefore I punched you in the nose.

(Invalid because of other possible nasal issues)

Invalid forms

Denying the antecedent

If A then B

not A

Therefore not B

Example of denying the antecedent

If I push the book then it will move.

I didn't push the book.

Therefore it didn't move.

(Invalid because of other possible causes)

Sailing the three C's

- Need to read arguments:
 - carefully
 - critically
 - charitably
- In brief this means:
 - identifying each and all assertions
 - determining if the argument is valid and/or sound
 - trying to make the arguments as plausible as possible

Being charitable

- Often possible to paraphrase the explicit statements in an argument
- Essential that the premise as paraphrased says exactly same thing as the original.
- The economy will be in big trouble, because it cannot tolerate the continuation of low interest rates, but such rates will continue.
- Better re-phrasing: "If low interest rates continue, then the economy will be in big trouble." (plus "Such rates will continue")

Determining validity

- We can summarize the steps needed to determine the validity of an argument as follows:
 - A. Identify the conclusion. (careful)
 - B. Identify the premises. (careful)
 - C. Identify reasonable and stated premises. (charitable)
 - D. Determine whether the argument is valid (if not considered conservative modifications that would make it valid). (critical)

Islamic-world argument

If America and the world's other governments in their completely justified, very necessary, and much overdue "war against terrorism" will also commit part of this long and difficult struggle to the creation of a good, right, and just society, if they do so in a way that follows the accepted standards of justice, and if they harm no innocent citizens of any nation in the process, then it should be expected they will receive the full and continued support of virtually every Muslim in the World.

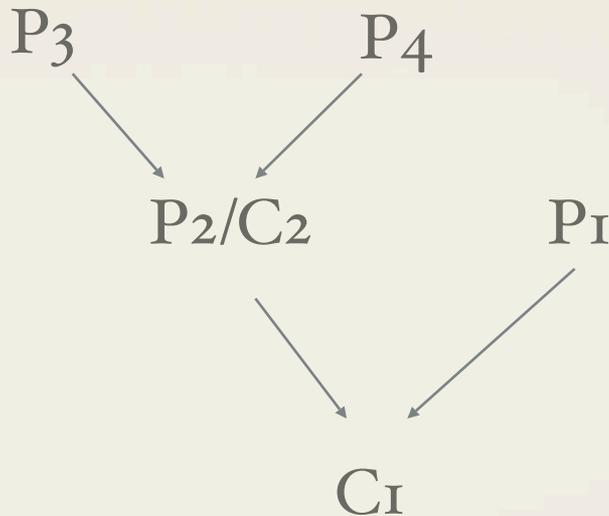
Regarding the issue of exploitation, particularly economic exploitation, we view as highly significant a comment made in an address to the people of America several years ago by then President of the United States, Bill Clinton, who said, "America with about five percent of the world's population utilizes about forty percent of the world's resources; and, we are going to have to work ever harder to keep it that way." When you are an African parent sitting homeless in the dust, hungry and thirsty, while your children die slowly before your eyes it is easy to see the blatant unfairness of this economic disparity. Is it then surprising that there will be anger toward America? Allah has told us that wealth must be equitably distributed among the world's people and nations.

Islamic-world argument

- Main argument
 - P₁) If America commits part of their struggle to the creation of a just society and follow accepted standards of justice and harm no innocent citizens then they will receive the support of all Muslims.
 - P₂) America does not follow the accepted standards of justice.
 - C₁) Therefore they won't receive support of all Muslims. (invalid)
- Argument for P₂
 - P₃) If you exploit other nations you do not follow the accepted standards of justice.
 - P₄) Bill Clinton made a statement showing that the Americans will continue to attempt to exploit other nations.
 - Therefore C₂/P₂. (valid)

Argument structure

- Draw the argument structure:



- Simple repair?
 - If they want to get support then follow justice...
 - Or, “If and only if” i.e. $A \rightarrow B$ & $B \rightarrow A$

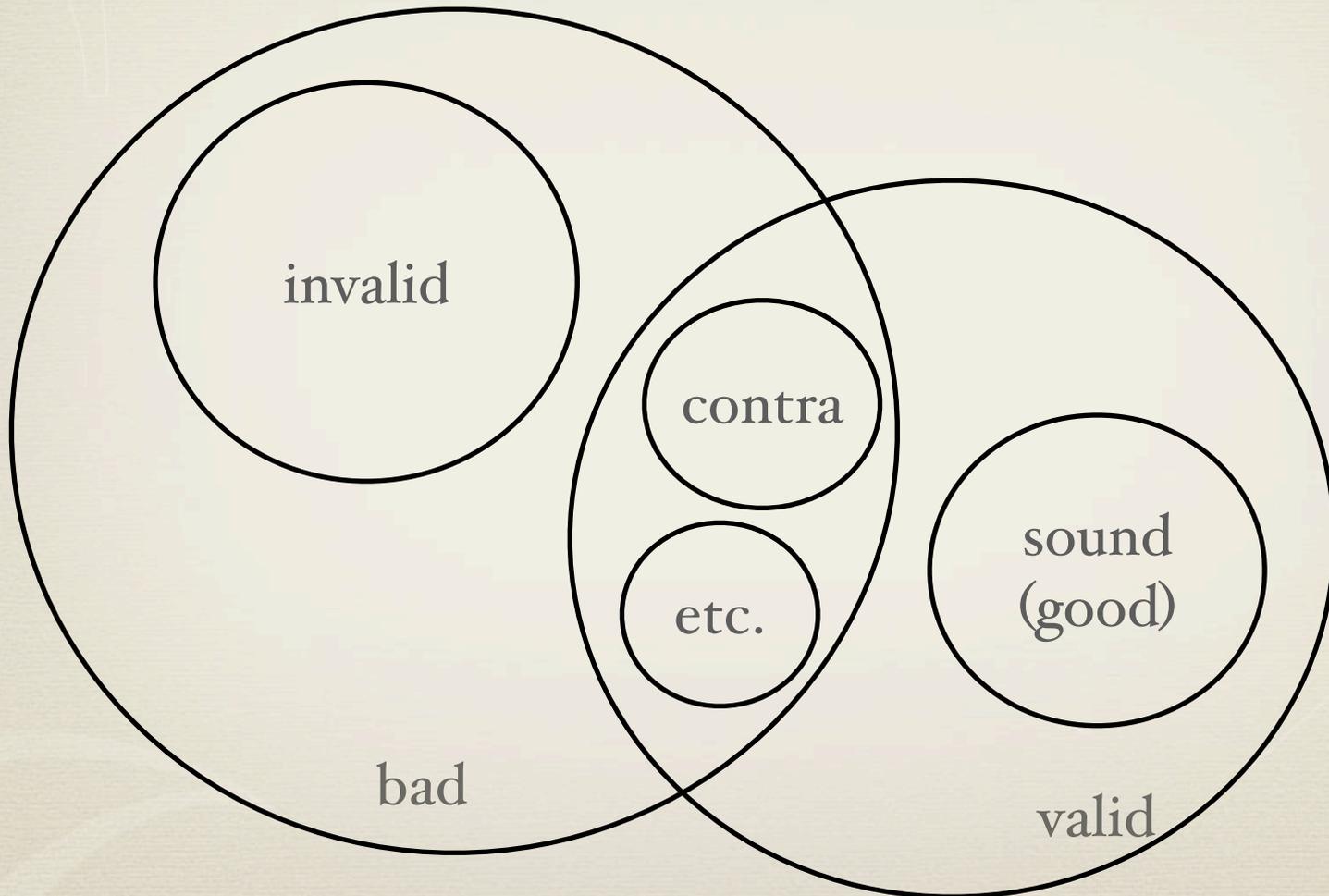
Criticizing valid arguments

- If the argument is definitely valid, then, as a critic you have at least three remaining possibilities:
 1. Show that one of the premises is false (the argument is unsound)
 2. Suggest that one of the premises is unjustified (that is, demand more reasons for thinking that premise is true)
 3. Show that the argument is unclear or vague, or of poor form

Classifying arguments

Good (sound)	Sound (and valid) Exception: Tautology	
Bad (not sound)	Invalid	
	Valid	not sound contradiction

Classifying arguments



Vagueness

- 2000 years ago, Sophists exploited vagueness (still do).
- What are sources and pitfalls of vagueness?
- *Vagueness and Context*

Example: Ann went to the store. She bought some muffins.

('She' refers to the individual 'Ann'.)

Example: Ann went near the store. She got muffins while she was there.

('There' refers to 'a vicinity' near the store, which could be any number of places.)

Vagueness

- *Ambiguity*
 - Lexical ambiguity
 - *Example:* He kicked his can.
 - Syntactic ambiguity
 - *Example:* Defining your terms clearly strengthens your argument.
 - Contextual ambiguity
 - *Example:* John's father wanted the key with him.

Vagueness

- *Equivocation (scope fallacies)*

P1) Hot dogs are better than nothing.

P2) Nothing is better than steak.

C) Therefore, hot dogs are better than steak.

The existence of a law means that there must be a law maker. But we know that the law of gravity and other scientific laws have not been made by any human law maker. So it follows that there must be a non-human law maker, God.

Everybody loves somebody. Therefore, everybody loves one of us.

Vagueness

- *Connotation (i.e. using emotion to affect reasoning)*

Example: He sure is <<debonaire, easy-going, devil-may-care, reckless>>

- *Euphemism*

- *Example:* neutralize, collateral damage, friendly fire,

- *Instead of content*

- *Example:* "Have a coke and a smile" "Pepsi, taste of a new generation" "Toyota Corolla. It just wants to have fun."

- *Jargon/Bafflegab (why? it works)*

- Example: Digging a hole: The author of this report utilized a manually operated soil displacement implement to facilitate the synergistic excavation of a negative volume of mineral aggregate relative to a datum plane defined at ground level.

Vagueness

- *Connotation (cont.)*

- *Loaded Verbs*

- *Example:* Surely you realize that using jargon just confuses the audience.
 - *Versus:* Surely you believe that using jargon just confuses the audience.

- *Insinuation*

- *Example:* Today, you were on time
 - *Example:* You should not speak ill of your friends (move emphasis).

Question and Example

- Question:
- Example: Char Margolis Cold Reading
- Example: Florsheim Magnetic Shoes (others include BIOFlex insoles/shoes).

Bonus: Is it valid?

- The pen in my hand is red and five hundred pounds. It is not red. Therefore it is five hundred pounds.
1. $A \ \& \ B$
 2. $\neg A$
 3. A (from 1)
 4. $\neg A \vee B$ (from 2; i.e. $A \Rightarrow B$)
 5. B (conclusion; from 4 and 3 or directly from 1)
- Is it a valid deduction? *Technically* it is (i.e. given the agreed upon definition of what to do with contradiction).
 - What's wrong, then? It cannot possibly be sound, given the law of non-contradiction.