

# How to be **ARGUMENTATIVE**

Words, Logic and Reasoning in Paediatric Medicine

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- **Lexicology** : The study of the form, history and origin of words
- **Logic** : The study of reasoning, proof, thinking or inference
  - the branch of philosophy that analyzes inference
  - reasoned and reasonable judgment

# Words

- semantics (from the Greek *semantikos*, or "significant meaning," derived from *sema*, sign) is the study of meaning
- syntax pertains to the formal structure/patterns in which something is expressed (for example written or spoken).

# Use of language

- informative use of language - assumes content is true
- expressive use of language – vent feelings
- directive use of language – give orders
- emotive meaning - expresses some (positive or negative) feeling about words.

# Intuition

Direct, non-inferential awareness of abstract objects or concrete truths.

- Plato held that intuition is a superior faculty, and
- Spinoza supposed that intuition is the highest sort of human knowledge.
- Russell, on the other hand, designated as intuitive any unreflective instance of knowledge by acquaintance
- NOTHING TO DO WITH THIS PRESENTATION

# Logic and Reasoning

Proposition: a statement – a declarative sentence

Argument = 2 or more propositions related in such a way that the premises (first statements) provide support for the conclusion

The logical connection between them is the inference on which the argument relies

## ■ Deductive Inferences

- When an argument claims that the truth of its premises **guarantees** the truth of its conclusion, it is said to involve a deductive inference

A (must)  $\rightarrow$  B

## ■ Inductive Inferences

- When an argument claims merely that the truth of its premises make it **likely or probable** that its conclusion is also true, it is said to involve an inductive inference

A (might)  $\rightarrow$  B

# Argument

- An argument is, to quote the Monty Python sketch, “a connected series of statements to establish a definite proposition.”
- Many types of argument exist
  - Deductive arguments are generally viewed as the most precise and the most persuasive; they provide conclusive proof of their conclusion, and are either *valid* or *invalid*.
  - Deductive arguments have three stages: premises, inference, and conclusion.

# Premises, Inferences and Conclusions

<u>Premises</u>	<u>Inference</u>	<u>Conclusion</u>
True	Valid	True (sound argument)
	Invalid	<del>True</del>
False	Valid	False
	Invalid	True
		False
		True

- The only thing that cannot happen is for a deductive argument to have true premises and a valid inference but a false conclusion.

# Deductive argument

- A deductive argument is said to be valid when the inference from premises to conclusion is perfect.
- Here are two equivalent ways of stating that standard:
  - If the premises of a valid argument are true, then its conclusion must also be true.
  - It is impossible for the conclusion of a valid argument to be false while its premises are true

# Logic

## ■ Informal logic

- logic which can be used to assess, analyse and improve the **informal reasoning** that occurs in the course of personal exchange, advertising, political debate, legal argument, and in the types of social commentary found in newspapers, television, the World Wide Web and other forms of mass media.

## ■ Formal logic

- The study of the properties of propositions and deductive reasoning by abstraction and **analysis of the form** rather than the content of propositions under consideration
  - mathematical equations
  - diagrammatic positions, Venn diagrams,
  - tables

# Informal logic

explanation of rules of communication on which argumentative exchange depends

- a distinction between different kinds of dialogue in which argument may occur
  - (e.g. scientific discussion vs collective bargaining)
- an account of logical consequence, which explains when it can be said (and what it means to say) that one sentence is a logical consequence of another
- general criteria for good argument, which may be associated with a theory of logical consequence
- definitions of positive argument schema which define good patterns of reasoning
  - (reasonable appeals to authority, reasonable attacks against the person; etc.)
- some theoretical account of fallacies and the role they can (and cannot) play in understanding and assessing informal arguments;
- an account of the role that audience (*pathos*) and *ethos* and other rhetorical notions should play in analysing and assessing argument;
- an explanation of the dialectical obligations that attach to arguments in particular kinds of contexts.

# Incorrect reasoning

Patterns of reasoning that are obviously incorrect

## ■ informal fallacy

- An attempt to persuade that obviously fails to demonstrate the truth of its conclusion, deriving its only plausibility from a misuse of ordinary language
- "I have made good judgments in the past. I have made good judgments in the future."

G.W.Bush

# Formal logic and reasoning

## A. Deduction (deductive reasoning)

$A \text{ (must) } \rightarrow B$

Form of the argument

- Premises and propositions
- Inferences
- Conclusions
- Fallacies of logic

# Premises

A deductive argument always requires a number of core assumptions. These are called *premises*, and are the assumptions the argument is built on; the reasons for accepting the argument.

- You should always state the premises of the argument explicitly; this is the principle of audiatur et altera pars.
- The premises of an argument are often introduced with words such as "Assume...", "Since...", "Obviously..." and "Because...." It is a good idea to get your opponent to agree with the premises of your argument before proceeding any further.
  - The word "obviously" is also often viewed with suspicion. It occasionally gets used to persuade people to accept false statements, rather than admit that they don't understand why something is 'obvious'. So don't be afraid to question statements which people tell you are 'obvious'

# Embedded premise

- Assertion hidden within the statement.
- Eg.,
  - Have you stopped beating your wife?

# Premises

A statement that is assumed to be true and from which a conclusion can be drawn.

- "praemissus" meaning "placed in front".
- An assumption or stipulation that precedes deductive reasoning.

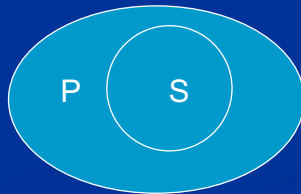
# Propositions

- A *proposition* is a statement which is either true or false. The proposition is the **meaning of the statement**, not the precise arrangement of words used to convey that meaning.
  - For example, "There exists an even prime number greater than two" is a proposition. (A false one, in this case.) "An even prime number greater than two exists" is the same proposition, re-worded.
- It is generally safer to consider the wording of a proposition as significant.
- It is possible to use formal linguistics to analyze and rephrase a statement without changing its meaning.

# Universal affirmative proposition

A universal affirmative proposition (to which, following the practice of medieval logicians, we will refer by the letter "A") is of the form

- All S are P.
- Such a proposition asserts that every member of the class designated by the subject term is also included in the class designated by the predicate term. Thus, it distributes its subject term but not its predicate term.



# Universal negative proposition

A universal negative proposition (or "E") is of the form

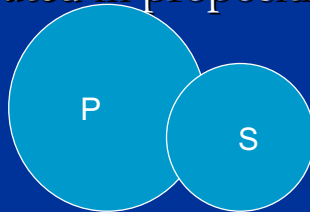
- No S are P.
- This proposition asserts that nothing is a member both of the class designated by the subject term and of the class designated by the predicate terms. Since it reports that every member of each class is excluded from the other, this proposition distributes both its subject term and its predicate term.



# Particular affirmative proposition

A particular affirmative proposition ("I") is of the form

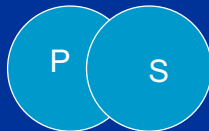
- Some S are P.
- A proposition of this form asserts that there is at least one thing which is a member both of the class designated by the subject term and of the class designated by the predicate term. Both terms are undistributed in propositions of this form.



# Particular negative proposition

Finally, a particular negative proposition ("O") is of the form

- Some S are not P.
- Such a proposition asserts that there is at least one thing which is a member of the class designated by the subject term but not a member of the class designated by the predicate term. Since it affirms that the one or more crucial things that they are distinct from each and every member of the predicate class, a proposition of this form distributes its predicate term but not its subject term.



# CATEGORICAL SYLLOGISMS

- A categorical syllogism is a deductive argument containing three statements: two premises and one conclusion.
- Each of the three statements is a categorical statement. These statements can be of the form:
  - All S are P,
  - No S are P,
  - Some S are P, or
  - Some S are not P.
- An example of a valid categorical syllogism is:
  - All humans are mortal.
  - Socrates is a human.
  - Therefore, Socrates is mortal.

# Inference

- Once the premises have been agreed, the argument proceeds via a step-by-step process called *inference*.
- In inference, you start with one or more propositions which have been accepted; you then use those propositions to arrive at a new proposition (or conclusion). If the inference is **valid**, that proposition should also be accepted.
- So initially, you can only infer things from the premises of the argument. But as the argument proceeds, the number of statements available for inference increases.
- There are various kinds of valid inference - and also some **invalid** kinds. Inference steps are often identified by phrases like "therefore..." or "...implies that..."

# Conclusion

- Hopefully you will arrive at a proposition which is the conclusion of the argument - the result you are trying to prove.
- The conclusion is the result of the **final step** of inference. It's only a conclusion in the context of a particular argument.
- The conclusion is said to be *affirmed* on the basis of the premises, and the inference from them.

# Fallacies

- There are a number of common pitfalls to avoid when constructing a deductive argument; they're known as *fallacies*. In everyday English, we refer to many kinds of mistaken beliefs as fallacies; but in logic, the term has a more specific meaning: **a fallacy is a technical flaw which makes an argument unsound or invalid.**
- (Note that you can criticize more than just the soundness of an argument. Arguments are almost always presented with some specific purpose in mind -- and the intent of the argument may also be worthy of criticism.)
- Arguments which contain fallacies are described as *fallacious*. They often appear valid and convincing; sometimes only close inspection reveals the **logical flaw**.

It's going to require a president who understands  
it's in our strategic interests to have a peaceful  
and economically viable hemisphere.

G.W.Bush March, 2000

NEXT = INFERENCE

# List of rules of Inference

- Reductio ad absurdum

- **Known conditional transformation rules**

- Modus ponens

- Modus tollens

- Conjunction

- Disjunction

- Simplification

- Addition

- Repetition

- Disjunctive syllogism

- Hypothetical syllogism

- Constructive dilemma

- Destructive dilemma

- **Known biconditional transformation rules**

- Double negative elimination

- Implication

- Contraposition

- Exportation

- Distribution

- De Morgan's Laws

- Commutation

- Association

- Tautology

- Equivalence

- **Hypothetical transformation rules**

- Conditional proof

- Indirect proof

- 

["http://en.wikipedia.org/wiki/List of rules of inference"](http://en.wikipedia.org/wiki/List_of_rules_of_inference)

# Immediate inferences

- Conversion
- Obversion
- Contra-position

# Immediate Inferences

## Conversion

- The converse of any categorical proposition is the new categorical proposition that results from putting the predicate term of the original proposition in the subject place of the new proposition and the subject term of the original in the predicate place of the new.
- Thus, for example, the converse of
  - "No dogs are felines"
  - is "No felines are dogs,"
- and the converse of
  - "Some snakes are poisonous animals"
  - is "Some poisonous animals are snakes."
- And the converse of
  - "Some retinal haemorrhages are injuries caused by child abuse"
  - Is "some injuries caused by child abuse are retinal haemorrhages"

# Immediate inferences

## Obversion

- In order to form the obverse of a categorical proposition, we replace the predicate term of the proposition with its complement and reverse the quality of the proposition, either from affirmative to negative or from negative to affirmative.
  
- Thus, for example, the obverse of
  - "All ants are insects" is
  - "No ants are non-insects";
  
- And the obverse of
  - "all child abuse is harmful"
  - Is "no child abuse is non-harmful"

# Immediate inferences

## Contraposition

- The contrapositive of any categorical proposition is the new categorical proposition that results from putting the complement of the predicate term of the original proposition in the subject place of the new proposition and the complement of the subject term of the original in the predicate place of the new.
- Thus, for example, the contrapositive of
  - "All crows are birds" is
  - "All non-birds are non-crows,"
- And the contrapositive of
  - "all corner fractures are abusive injuries" is
  - "all non-abusive injuries are non-corner fractures"

# Modus Ponens

(Latin: *mode that affirms*) is a valid, simple argument form (often abbreviated to **MP**):

- If P, then Q.
- P.
- Therefore, Q.

■ or in logical operator notation:

- $p \rightarrow q$
- $p$
- $\therefore q$

where  $\therefore$  represents the logical assertion.

■ The argument form has two premises.

- The first premise is the "if-then" or conditional claim, namely that P implies Q.
- The second premise is that P, the *antecedent* of the conditional claim, is true.
- From these two premises it can be logically concluded that Q, the *consequent* of the conditional claim, must be true as well.

# Modus tollens

(Latin: *mode that denies*) is the formal name for **indirect proof** or **proof by contrapositive**, often abbreviated to **MT**

- It is a common, simple argument form:
  - If P, then Q.
  - Q is false.
  - Therefore, P is false.
  
- The argument has two premises.
  - The first premise is the conditional "if-then" statement, namely that P implies Q.
  - The second premise is that Q is false.
  - From these two premises, it can be logically concluded that P must be false

The ambassador and the general were briefing me on the vast majority of Iraqis want to live in a peaceful, free world. And we will find these people and we will bring them to justice.

George W. Bush, Washington, D.C., Oct. 27, 2003

**NEXT = FALLACIES**

# Fallacies

- 1. Reductio ab absurdum
- 2. Fallacies of relevance
- 3. Fallacies of presumption
- 4. Fallacies of ambiguity

# 1. Reductio ab absurdum

(Latin for "reduction to the absurd", traceable back to the Greek "reduction to the impossible", often used by Aristotle)

It is a type of logical argument where we assume a claim for the sake of argument, arrive at an absurd result, and then conclude the original assumption must have been wrong, since it gave us this absurd result.

This is also known as **proof by contradiction**.

It makes use of the law of excluded middle — a statement which cannot be false, must then be true.

*Autism predominantly affects males. Since research suggests fairly significant differences between average male and female brains, is it possible that autism is simply an extreme form of male behaviour?*

## 2. Fallacies of Relevance

- Appeal to force
- Appeal to pity
- Appeal to emotion
- Appeal to authority
- Ad hominem argument
- Appeal to ignorance
- Irrelevant conclusion

# Appeal to force

*(argumentum ad baculum)*

- In the appeal to force, someone in a position of power threatens to bring down unfortunate consequences upon anyone who dares to disagree with a proffered proposition.
- Although it is rarely developed so explicitly, a fallacy of this type might propose:
  - *If you do not agree with my political opinions, you will receive a grade of F for this course.*

# Appeal to pity

*(argumentum ad misericordiam)*

- Turning this on its head, an appeal to pity tries to win acceptance by pointing out the unfortunate consequences that will otherwise fall upon the speaker and others, for whom we would then feel sorry.
  - *I am a single parent, solely responsible for the financial support of my children.*

# Appeal to emotion

*(argumentum ad populum)*

- In a more general fashion, the appeal to emotion relies upon emotively charged language to arouse strong feelings that may lead an audience to accept its conclusion:
  - *As all clear-thinking residents of our fine state have already realized, the Premier's plan for financing public education is nothing but the bloody-fanged wolf of socialism cleverly disguised in the harmless sheep's clothing of concern for children.*
  - *Therefore, the Premier's plan is bad public policy.*

# Appeal to authority

*(argumentum ad verecundiam)*

- the opinion of someone famous or accomplished in another area of expertise is supposed to guarantee the truth of a conclusion.
  - Thus, for example,  
*Federal Reserve Chair Alan Greenspan believes that spiders are insects.*
  - *Therefore, spiders are insects.*

# Ad Hominem Argument

## *Ad Hominem Argument*

- The mirror-image of the appeal to authority is the *ad hominem argument*, in which we are encouraged to reject a proposition because it is the stated opinion of someone regarded as disreputable in some way.
- This can happen in several different ways, but all involve the claim that the proposition must be false because of who believes it to be true:
  - *Mr. X (who is lazy, inept, divorced and a fool) believes that the Family Court should order children to reside 50% of their time with either parent.*

# Appeal to ignorance

*(argumentum ad ignoratiam)*

- the absence of evidence against a proposition is not enough to secure its truth.
- What we don't know could nevertheless be so.
  - *The anti-athiest argument? (God might exist?)*

# Irrelevant Conclusion

*(ignoratio elenchi)*

- irrelevant conclusion tries to establish the truth of a proposition by offering an argument that actually provides support for an entirely different conclusion.
  - *All children should have ample attention from their parents.*
  - *Parents who work full-time cannot give ample attention to their children.*
  - *Therefore, mothers should not work full-time.*

# 3. Fallacies of presumption

Fallacies of presumption:

- accident,
- converse accident,
- false cause,
- begging the question, and
- complex question

# Accident

The fallacy of accident begins with the statement of some principle that is true as a general rule, but then errs by applying this principle to a specific case that is unusual or atypical in some way.

- *Women earn less than men earn for doing the same work.*
- *Oprah Winfrey is a woman.*
- *Therefore, Oprah Winfrey earns less than male talk-show hosts.*

# Converse Accident

The fallacy of converse accident begins with a specific case that is unusual or atypical in some way, and then errs by deriving from this case the truth of a general rule.

- *Dennis Rodman wears earrings and is an excellent rebounder.*
- *Therefore, people who wear earrings are excellent rebounders*

# False cause

The fallacy of false cause infers the presence of a causal connection simply because events appear to occur in correlation or (in the post hoc, ergo propter hoc variety) temporal succession.

- *The moon was full on Thursday evening.*
- *On Friday morning I overslept.*
- *Therefore, the full moon caused me to oversleep.*

# Begging the question

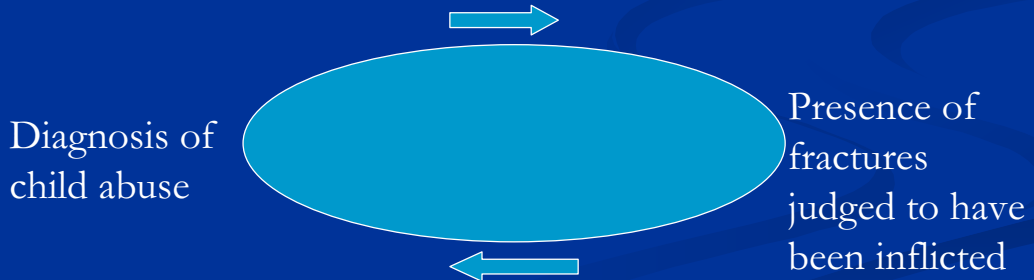
*(petitio principii)*

- Begging the question is the fallacy of using the conclusion of an argument as one of the premises offered in its own support. Although this often happens in an implicit or disguised fashion, an explicit version would look like this:
  - *All dogs are mammals.*
  - *All mammals have hair.*
  - *Since animals with hair bear live young, dogs bear live young.*
  - *But all animals that bear live young are mammals.*
  - *Therefore, all dogs are mammals.*

# A particular “begging the question”

## Circular argument

- A **circular argument** makes a conclusion based on material that has already been assumed in the argument:



# Complex question

The fallacy of complex question presupposes the truth of its own conclusion by including it implicitly in the statement of the issue to be considered:

- *Have you tried to stop watching too much television?*
- *If so, then you admit that you do watch too much television.*
- *If not, then you must still be watching too much television.*
- *Therefore, you watch too much television.*

# 4. Fallacies of Ambiguity

- Ambiguous language
- Equivocation
- Amphiboly
- Accent
- Composition
- Division

# Ambiguous language

Double and triple entendre

- Poor people abuse their kids
- I'm mad about child abuse

# Amphiboly

An amphiboly can occur even when every term in an argument is univocal, if the grammatical construction of a sentence creates its own ambiguity.

For example,

- *A reckless motorist Thursday struck and injured a student who was jogging through the campus in his pickup truck.*
- *Therefore, it is unsafe to jog in your pickup truck.*

# Accent

The fallacy of accent arises from an ambiguity produced by a shift of spoken or written emphasis.

Thus, for example:

- *Jorge turned in his assignment on time **today**.*
- *Therefore, Jorge usually turns in his assignments late.*

# Composition

The fallacy of composition involves an inference from the attribution of some feature to every individual member of a class (or part of a greater whole) to the possession of the same feature by the entire class (or whole).

- *Every course I took in college was well-organized.*
- *Therefore, my college education was well-organized.*

# Division

Similarly, the fallacy of division involves an inference from the attribution of some feature to an entire class (or whole) to the possession of the same feature by each of its individual members (or parts).

- *Ocelots are now dying out.*
- *Sparky is an ocelot.*
- *Therefore, Sparky is now dying out.*

Our enemies are innovative and resourceful, and so are we. They never stop thinking about new ways to harm our country and our people, and neither do we.

- G.W.Bush Aug, 5, 2004

**NEXT = INDUCTIVE REASONING**

# Logic and Argument

B. Induction (Inductive reasoning)

A (might)  $\rightarrow$  B

- 1. Analogical reasoning
- 2. Causal reasoning

# 1. Analogical reasoning

- The simplest variety of inductive reasoning is argument by analogy, which takes note of the fact that two or more things are similar in some respects and concludes that they are probably also similar in some further respect
  1.  $A$  is  $F$  and  $G$
  2.  $B$  is  $F$
  - $\therefore C$ .  $B$  is  $G$ .
  - 1. *Children are weak and helpless and best cared for by women.*
  - 2. *The ill and infirm are weak and helpless.*
  - $\therefore C$ . *The ill and infirm are best cared for by women.*

# Evaluating analogies

## IN GENERAL, CONSIDER

- **Number of instances.** More instances strengthen an analogy; fewer weaken it.
- **Instance variety.** More variety there is among the instances, the stronger the analogical argument becomes.
- **Number of similarities.** More similarities there are between the instances and my conclusion, the better for the analogical argument.
- **Relevance.** Relevance is not something about which we can be terribly precise; it is always possible in principle to tell a story in the context of which anything may turn out to be relevant. So we just have to use our best judgment in deciding whether or not some respect deserves to be considered.
- **Number of dissimilarities.** Fewer dissimilarities between instances and conclusion, the better an analogical argument is.
- **Modesty of conclusion.** Arguments by analogy are improved when their conclusions are modest with respect to their premises.

## 2. Causal reasoning

### Causation

- Another common variety of inductive reasoning is concerned with establishing the presence of causal relationships among events.
- When we have good reason to believe that events of one sort (the causes) are systematically related to events of some other sort (the effects), it may become possible for us to alter our environment by producing (or by preventing) the occurrence of certain kinds of events.

# Causal relationships

## Mill's Methods

- Philosopher *John Stuart Mill* devised a set of five careful methods (or canons) by means of which to analyze and interpret our observations for the purpose of drawing conclusions about the causal relationships they exhibit.

# Mill's methods -1.

## Method of Agreement

- Suppose that four students come to Ms. Hayes with indigestion, and she questions each about what they had for lunch. The first had pizza, coleslaw, orange juice, and a cookie; the second had a hot dog and french fries, coleslaw, and iced tea; the third ate pizza and coleslaw and drank iced tea; and the fourth ate only french fries, coleslaw, and chocolate cake. Ms. Hayes, of course, concludes that "Eating coleslaw caused the indigestion."
- This is an application of Mill's Method of Agreement: investigation of the cases in which the effect occurred revealed only one prior circumstance that all of them shared. Our customary notion here is that similar effects are likely to arise from a similar cause, and since everyone who fell ill had eaten coleslaw, it was probably the cause.

# Mill's method's - 2.

## Method of Difference

- On the other hand, suppose that only two students arrive at the Nurse's office. The two are roommates who ate together, but one became ill while the other did not. The first had eaten a hot dog, french fries, coleslaw, chocolate cake, and iced tea, while the other had eaten a hot dog, french fries, chocolate cake, and iced tea. Again, Ms. Hayes concludes that the coleslaw is what made the first roommate ill.
- This reasoning applies Mill's Method of Difference: comparison of a case in which the effect occurred and a case in which the effect did not occur revealed that only one prior circumstance was present in the first case but not in the second. In such situations, we commonly suppose that, other things being equal, different effects are likely to arise from different causes, and since only the student who had eaten coleslaw became ill, it was probably the cause.

# Mill's methods - 3

## Joint Method of Agreement and Difference

- Now put these two situations together by assuming that eight students come to Ms. Hayes: four of them suffered from indigestion, and with each of these four there is another who did not. Each pair of students had exactly the same lunch, except that everyone in the first group ate coleslaw and no one in the second group did. The Nurse arrives at the same conclusion.
- This situation is an example of Mill's Joint Method of Agreement and Difference: the first four students are evidence that everyone who got ill had eaten coleslaw, and the four matching pairs are evidence that only those who got ill had eaten coleslaw. This is a powerful combination of the first two methods, since it tends to support our notion that genuine causes are necessary and sufficient conditions for their effects.

# Mill's methods - 4

## Method of Concomitant Variation

- Change the situation again. Suppose that the Nurse sees five students: the first ate no coleslaw and feels fine; the second had one bite of coleslaw and felt a little queasy; the third had half a dish of coleslaw and is fairly ill; the fourth ate a whole dish of coleslaw and is violently ill; and the fifth ate two servings of coleslaw and had to be rushed to the hospital. The conclusion is again that coleslaw caused the indigestion.
- This is an example of Mill's Method of Concomitant Variation: the evidence appears to show that there is a direct correlation between the degree to which the cause occurred and the degree to which the effect occurred. This conforms to our ordinary supposition that effects are typically proportional to their causes. In effect, this is a sophisticated version of the Joint Method, one in which we notice not just the occurrence or non-occurrence of the causal terms, but the extent to which each of them took place.

# Mill's methods - 5

## Method of Residues

- Finally, suppose that Ms. Hayes, during prior investigations of student illness, has already established that pizza tends to produce a rash and iced tea tends to cause headaches. Today, a student arrives at the Nurse's office complaining of headache, indigestion, and a rash; this student reports having eaten pizza, coleslaw, and iced tea for lunch. Since she can account for most of the student's symptoms as the effects of known causes, Ms. Hayes concludes that the additional effect of indigestion must be caused by the additional circumstance of eating coleslaw.
- This pattern of reasoning exemplifies Mill's Method of Residues: many elements of a complex effect are shown to result, by reliable causal beliefs, from several elements of a complex cause; whatever remains of the effect must then have been produced by whatever remains of the cause. Notice that if we suppose the truth of all of the causal relationships involved, this method becomes an application of deductive reasoning.

Because he's hiding.

*-- Bush's explanation as to why Bin Laden has not been caught.*

*Air Force One, January 14, 2005*

**NEXT = WHY PAEDIATRICIANS  
NEED LOGIC**

# Scientific explanation

- The most productive model for the structure of a scientific explanation is that of a valid deductive argument whose conclusion is the event to be explained. Some of the premises of this argument will be factual statements of the antecedent circumstances, while the others will be the scientific hypotheses offered as a way of linking those circumstances to the outcome stated by the conclusion. Scientific predictions have exactly the same structure; the only difference between the explanation and the prediction of an event is whether or not it has already occurred.
- On this deductive-nomological model for scientific explanation, the conclusion of the argument must be true (that is, the event must occur) if all of the premises are true. Those of its premises that state the antecedent circumstances will naturally be true so long as we have our facts straight.

# The scientific method

What is often called the scientific method is nothing more than a step-by-step procedure for the conduct of scientific research:

- State the Problem.
  - It is important to begin with a clear statement of what phenomenon is to be investigated.
- Invent Preliminary Hypotheses.
- Collect Additional Information.
- Formulate a Hypothesis..
- Deduce Further Consequences.
- Test the Consequences.
- Apply the Hypothesis.

# Evaluating hypotheses

## CONSIDER

- Relevance.
- Testability. There must be some way of acquiring evidence that would tend to confirm or disconfirm the hypothesis. In fact, good hypotheses are always falsifiable in the sense that it is possible to state specific conditions under which the hypothesis would be decisively overturned.
- Compatibility. The hypothesis should fit well with what we already believe about the natural order of things.
- Predictive power. A good hypothesis isn't just a way of explaining events of this one sort, but will be applicable to many other kinds of circumstances as well.
- Simplicity. The best hypotheses are rarely intricate in structure.

# Probability and plausibility

- Probability
  - The likelihood of something happening
- Plausibility
  - Seemingly reasonable or probable

# Probability theory

## Calculation of Probability

- If we assign a numerical value of 1.0 as the probability of an event that must happen (signified by a tautologous statement) and a numerical value of 0.0 as that of an event that cannot happen (signified by a self-contradiction), then every degree of probability that lies in between these two extremes can be expressed as a decimal or fraction between 0.0 and 1.0.
- **Joint Occurrences**  $p(A*B) = p(A) \times p(B, \text{ if } A)$
- **Alternative Occurrences**  $(p(A \vee B) = p(A) + p(B) - p(A*B))$
- **Expected Value** (gambling, sum  $P(A) + p(B) + p(C)$  etc..

# Plausible

- Seemingly or apparently valid, likely, or acceptable; credible: *a plausible excuse*.
- appearing to merit belief or acceptance

EG. The 3 year old child sustained a spiral fracture to his left tibia during an unwitnessed accidental fall down stairs

We've got an issue in America.

Too many good docs are getting out of business.

Too many OB/GYNs aren't able to practice their  
love with women all across this country. G.W.Bush

NEXT = WRITING A  
MEDICAL REPORT

# Writing a medical report

- For whom?
- How will it be used?
- Who owns it?
  
- What qualifiers and protection is required?
  
- The format

# Medical Report

- Letterhead +/- logo                      ■
- Date
- For whom
- Title
- Re
  - name
  - Date of birth
  - Identifier
  - (NOT ADDRESS)

# Medical Report

- Who you are
  - full name,
  - qualifications
  - professional address
  - current position/title
  - experience in the field
- When and where you had contact with the child
- Who else was there
- Who provided consent and what consent was for
- All other sources of information

# Medical Report

- Who said what
  - Verbatim (some, not all information)
  - New paragraph per person
  - Allegations
- Headings optional
- Content
  - Allegation 1st
  - Concerning features
    - Delay in presentation
    - History changes over time
    - Differing histories given by individuals
  - The usual paediatric history

# Medical Report

- Allegations
  - What?
  - Who?
  - Where?
  - When?
  
- History
  - Specific
    - related to allegation
    - chronology
  - Nonspecific
    - past medical and developmental concerns
    - Child care practices
    - genogram

# Medical Report

- Examination - general
  - Demeanour, affect
  - Cooperation
  - Clothing
  - Measurements and percentiles
  - Skin
  - Orifices
    - Mouth, ears, eyes
  - Systems
  - Pattern recognition

# Medical Report

## ■ Examination - specific

- Injuries
  - Obvious
  - Search

## ■ Documentation

- Site
- Size
- Shape
- Colour
- Contour
- Edge
- Surface
- (pain, discharge, movement)

# Medical Report

## ■ Investigations

- What?
- When?
- Who interpreted findings?
- Implication(s) of findings?
- +/- sensitivity and specificity of the test (rarely)

## ■ Consultations

- Who ?
- What opinion ?

# Opinion

- Opinion – clear heading
  - Consider the argument
- Summarise allegations
  - 1st premise
- Summarise examination findings
  - 2<sup>nd</sup> premise
- How the 2 relate to each other
  - inference
- What you believe is the most likely cause for the child's condition
  - conclusion
- Other conditions to consider
  - Why they are or are not likely to be the cause of the child's condition
  - Conclusion

# Medical Report

- Limitations of your opinion
- Qualifiers
- Evidence on which your opinion is based
  - References (only VERY important or essential ones)
- Limit / permit the use or distribution of the report (not court documents- these “belong” to the court)

# Medical Report

## ■ CHECK IT

- Typing errors
- Grammatical errors, sloppy language, imprecise language, misleading language
- Errors of fact
- Errors of judgement
- Opinion = accurate and complete

## ■ Sign it

## ■ Send it (cc to all the relevant professionals)

# Avoid words with hidden assumptions

## ■ Disclosure

- Assumes the statements are factual
  - He disclosed that she hurt him.

## ■ Victim

- Assumes something bad happened to this person
  - The victim wept in court.

## ■ Offence

- Assumes crime has been committed
  - She said that he raped her

# Dubya

- The trouble with the French is they don't have a word for entrepreneur.
- More and more of our imports come from overseas.
- Security is the essential roadblock to achieving the road map to peace.  
*- Washington, D.C., July 25, 2003.*
- I want to go back to Washington. There is strong advice that I not, primarily from the vice president.  
*-- reported in Newsweek (International edition) December 3, 2001*
- We don't have a beef with Muslims.- *Washington, DC, October 25, 2001*
- They could still be hidden, like the 50 tons of mustard gas on a turkey farm (*referring to WMD*).  
*Washington, D.C. , April 13, 2004*

# More Dubya

- You teach a child to read, and he or her will be able to pass a literacy test.  
reported in *Newsweek*, March 5, 2001
- Redefining the role of the United States from enablers to keep the peace to enablers to keep the peace from peacekeepers is going to be an assignment.  
Washington, D.C. Jan. 14, 2001
- Rarely is the question asked, Is our children learning?
- There is a lot of speculation and I guess there is going to continue to be a lot of speculation until the speculation ends.  
*quoted in Austin-American Statesman, Oct 18, 1998*
- "The truth of that matter is, if you listen carefully, Saddam would still be in power if he (Gore) were the president of the United States, and the world would be a lot better off."  
—George W. Bush, second presidential debate, St. Louis, Mo., Oct. 8, 2004

If you don't stand for anything, you don't stand for anything. If you don't stand for something, you don't stand for anything.

*quoted in Austin-American Statesman, November 2, 2000*

.....finally.....