Science in Three Simple Steps

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December 9, 2010

1 How to do science

1. Think of a question and two hypotheses A and B that could be the answer. Make sure that A and B could both be true, given what we (as scientists) know so far. Even better, make sure that both A and B seem reasonable (for example, some scientist has proposed the idea in the past).*
2. Identify some possible empirical fact F that would be consistent with A, but not with B. In other words, A predicts that F is true, but B predicts that F is false. (Ideally, find many such facts.)
3. Find out whether F is true or false. If F is true, then you can rule out B; if F is false, then you can rule out A. (Ruling hypotheses out is like shrinking the context set; you add information by ruling possibilities out.)

Easy as 1-2-3!

*If nobody has ever thought of an explanation for some fact before, then I suppose it still counts as science if you can think of even a single hypothesis.

2 Familiar territory: Implication relations

Suppose a sentence P implies (not necessarily entails, but leads the listener to infer) a sentence Q.

Hypothesis A: P presupposes Q

Hypothesis B: P implicates Q

Hypothesis C: P entails (but does not presuppose) Q

Test	A?	B?	C?
cancellation OK: 'P but not Q' is felicitous	no	yes	no
cancellation bad: 'P but not Q' is infelicitous	yes	no	yes
reinforcement OK: 'P and Q' is felicitous	no	yes	no
reinforcement bad: 'P and Q' is infelicious	yes	no	yes
negation: '¬P' implies 'Q'	yes	no	no
question-formation: 'P?' implies 'Q'	yes	no	no

3 Presupposition projection with complement-taking verbs

Cumulative hypothesis: Presuppositions always project. More precisely: If a sentence E is embedded in a main clause M, and E presupposes P, then M also presupposes P.

Karttunen's hypothesis about complement-taking verbs: If a sentence E is embedded in a main clause M, and E presupposes P, then M also presupposes P, *but only if E is the complement of a hole, not when E is the complement of a plug.*

What facts would distinguish between these two hypotheses?

Example 1: Bill forced Fred to stop beating Zelda.

- M: Bill forced Fred to stop beating Zelda.
- E: Fred stopped beating Zelda.
- P: Fred has been beating Zelda.

Facts:

- E is embedded in M
- E presupposes P
- E is the complement of *force*
- *force* is a hole, not a plug

Cumulative hypothesis predicts: M also presupposes P ← Correct!

Karttunen's hypothesis predicts: M also presupposes P ← Correct!

So this example does not distinguish between the hypotheses.

Example 2: Bill ordered Fred to stop beating Zelda.

- M: Bill ordered Fred to stop beating Zelda.
- E: Fred stopped beating Zelda.
- P: Fred has been beating Zelda.

Facts:

- E is embedded in M
- E presupposes P

- E is the complement of *order*
- *order* is a plug, not a hole

Cumulative hypothesis predicts: M also presupposes P ← Incorrect!

Karttunen's hypothesis predicts: M does not presuppose P ← Correct!

The cumulative hypothesis fails to distinguish between Example 1 and Example 2 in the sense that it predicts that M presupposes P in both cases, even though M presupposes P only in the first case.

4 Presupposition projection in conditionals

Cumulative hypothesis: Presuppositions always project. More precisely: If a sentence E is embedded in a main clause M, and E presupposes P, then M also presupposes P. (Corollary: If the main clause M is a conditional sentence of the form 'if A then E', and E presupposes P, then M also presupposes P.)

Karttunen's hypothesis for conditionals: If M is a conditional sentence of the form 'if A then E', and E presupposes P, then M also presupposes P, unless A semantically entails P.

Example 1: If baldness is hereditary, then all of Jack's children are bald.

- E: All of Jack's children are bald.
- A: Baldness is hereditary.
- M: If baldness is hereditary, then all of Jack's children are bald.
- P: Jack has children.

Facts:

- M is a conditional sentence of the form 'if A then E'
- E presupposes P
- A does *not* semantically entail P

Cumulative hypothesis predicts: M presupposes P. ← Correct!

Karttunen's hypothesis predicts: M presupposes P. ← Correct!

Example 2: If all of Jack's children are bald, then baldness is hereditary.

- E: **Baldness is hereditary.**
- A: **All of Jack's children are bald.**
- M: If all of Jack's children are bald, then baldness is hereditary.
- P: Jack has children.

Facts:

- M is a conditional sentence of the form 'if A then E'
- E does *not* presuppose P
- A *does* semantically entail P
- But A also presupposes P

Cumulative hypothesis predicts: M presupposes P. ← Correct!

Karttunen's hypothesis predicts: M presupposes P. ← Correct!

Example 3: If Jack has children, then all of Jack's children are bald.

- E: All of Jack's children are bald.
- A: **Jack has children**
- M: If Jack has children, then all of Jack's children are bald.
- P: Jack has children.

Facts:

- M is a conditional sentence of the form 'if A then E'
- E presupposes P
- A *does* semantically entail P

Cumulative hypothesis predicts: M presupposes P. ← Incorrect!

Karttunen's hypothesis predicts: M does *not* presuppose P. ← Correct!