Entailment

Definition

A entails B if

1. whenever A is true, then B must be true, and
2. if B is false then A is false.

In a 2-value logic system where a proposition must either be true or false, (1) and (2) are equivalent.

However, in other logic systems, and also in linguistic expressions, it is possible for something to be neither true nor false. Then (1) and (2) are not the same.
Example 1

A1: *Carmen stole the Mona Lisa this morning.*

Entailment?
B1: Carmen stole something.
   If A1 is true, B1 must be true. **YES!**
   If B1 is false, A1 must be false. **YES!**
B2: Something was stolen this morning. **YES!**
B3: Carmen believes the Mona Lisa is valuable. **NO!!!**

Example 2

A2: *Who stole the Mona Lisa this morning?*

Entailment?
B1: Carmen stole something. **NO!!**
B2: Something was stolen this morning.
   To say A2, B2 must be true. **NO!!**
   If B2 is false, A2 is unutterable.
**Test for Entailment**

Falsifying the entailment

If A entails B, then falsifying B would falsify A.

**Upward Entailing**

- If one can infer by way of entailment from the property of set S to the superset of S, then the entailment is upward entailing.
Upward Entailment

- Some cows are brown.

Entailment:
- Some animals are brown.

- Animals are a superset of cows.

- This is a case of upward entailment.

Downward Entailment

- If one can infer by way of entailment from the property of set S to the subset of S, then the entailment is downward entailing.
Downward Entailing

- *Elephants are neither stupid nor ugly.*
  Entailments:
  - *Elephants are not stupid.*
  - *Elephants are not ugly.*

- Being stupid is a **subset** of being stupid or ugly. Likewise, being ugly is a **subset** of being stupid or ugly.

- This is a case of **downward entailment.**

Other Definitions of Entailment

- There are various definitions for **entailment.**
- E.g. If one assumes that something **must either be true or false,** and defines entailments as:
  - A entails B if when B is false, A is false.
- By this definition, B2 would be entailed by A2.

  A2: *Who stole the Mona Lisa this morning?*
  B2: *Something was stolen this morning.*
Further reading


McCawley, James D. (1981) Everything that Linguists have Always Wanted to Know about Logic* But were Ashamed to Ask, Chapter 1. Chicago: University of Chicago Press.

Further reading


The End

Wee, Lian-Hee and Winnie H.Y. Cheung (2009)
An animated and narrated glossary of terms used in Linguistics.
Hong Kong Baptist University.