

Appendix (to appear in the on-line Annex)

Truth-functional analyses of the conditional descriptions

Annex A: Truth-functional analyses of conditional descriptions used in the poor flowers scenario and light box scenario

In studying how people assign causal roles, Goldvarg and Johnson-Laird (2001; experiment 2) used descriptions analogous to the following one:

- (1) Given that poor flowers get enough sunlight: If a particular new fertilizer is added to the ground, then poor flowers grow well. However, if poor flowers do not get enough sunlight, then they do not grow well even if the new fertilizer is added to the ground.

They argued that the interpretation of such a description will result in five fully explicit models of possible situations:

(m1)	sunlight	fertilizer	growth
(m2)	sunlight	¬fertilizer	growth
(m3)	sunlight	¬fertilizer	¬growth
(m4)	¬sunlight	fertilizer	¬growth
(m5)	¬sunlight	¬fertilizer	¬growth

How is this set of models derived? It can be derived in two steps. First, we must assume – as Goldvarg and Johnson-Laird did (p. 588) – that description (1) is interpreted as three conditionals:

- I(1) If sunlight then if fertilizer then growth; and if not sunlight then not growth.

Then, we can apply propositional logic to determine which situations are consistent with this interpretation and which are not. The truth-functional definitions of the relevant logical operators are given in Table 1.

Table 1: Truth-functional definition of negation, implication, and conjunction.

p	q	negation ¬p	implication p → q	conjunction p ∧ q
t	t	f	t	t
t	f	f	f	f
f	t	t	t	f
f	f	t	t	f

t: true; f: false

If we abbreviate “sunlight” to S, “fertilizer” to F and “growth” to G, and if we assume that all three conditionals of interpretation I(1) are understood as logical implications (as defined above), we can construct the following truth table for interpretation I(1):

Table 2: Truth-functional analysis of interpretation I(1). All situations that are consistent with I(1) are printed **bold** faced.

S	F	G	$F \rightarrow G$	(1) $S \rightarrow (F \rightarrow G)$	(2) $\neg S \rightarrow \neg G$	Interpretation I(1) $(1 \wedge 2)$
t	t	t	t	t	t	t (m1)
t	t	f	f	f	t	f
t	f	t	t	t	t	t (m2)
t	f	f	t	t	t	t (m3)
f	t	t	t	t	f	f
f	t	f	f	t	t	t (m4)
f	f	t	t	t	f	f
f	f	f	t	t	t	t (m5)

t: true; f: false

The five situations that are consistent with interpretation I(1) correspond directly with the five models Goldvarg and Johnson-Laird assumed for their original description.

Which models are consistent with the following switched description (1s)?

- (1s) Given that a particular new fertilizer is added to the ground: If poor flowers get enough sunlight then poor flowers grow well. If poor flowers grow well then they have got enough sunlight.

If we apply the interpretation scheme of Goldvarg and Johnson-Laird, this description can be paraphrased as:

I(1s) If fertilizer then if sunlight then growth; and if growth then sunlight.

The truth-functional analysis of interpretation I(1s) is presented in Table 3. By comparing Table 2 and Table 3, we can see that the five situations that are consistent with interpretation I(1s) are identical to the ones for interpretation I(1). All other descriptions that we used in our experiment are logically equivalent to descriptions (1) or (1s); they only differ in the causal roles (2 and 2s), in the content (light box scenario), or in the position of the framing assumption respectively (3' and 3's).

Table 3: Truth-functional analysis of interpretation I(1s). All situations that are consistent with I(1s) are printed **bold** faced.

F	S	G	$S \rightarrow G$	(1) $F \rightarrow (S \rightarrow G)$	(2) $G \rightarrow S$	Interpretation I(1s) $(1 \wedge 2)$
t	t	t	t	t	t	t (m1)
t	t	f	f	f	t	f
t	f	t	t	t	f	f
t	f	f	t	t	t	t (m4)
f	t	t	t	t	t	t (m2)
f	t	f	f	t	t	t (m3)
f	f	t	t	t	f	f
f	f	f	t	t	t	t (m5)

t: true; f: false