MEANING REVERSAL IN MULTIPLY NEGATED SENTENCES — NEW EVIDENCE FROM TWO TASKS

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INTRODUCTION

- Wason & Reich (1979) observed that (1) is usually misinterpreted to mean *Treat all head injuries, no matter how trivial*:

  (1) No head injury is too trivial to be ignored.

  Compositional meaning:

  Ignore all head injuries, no matter how trivial

  Compare: No missile is too small to be banned (→ ban all)

- Wason & Reich speculated that the illusion is due to **negation overload at the verb**:

no +	(global negation)
too +	(too x to y → ¬ y)
trivial +	(≈ ¬ serious)
ignore	(≈ ¬ treat)

- Paape & Vasishth (2017) found some eye tracking evidence consistent with the verb being the locus of the illusion
- O'Connor (2015) also observed the illusion in sentence completions when no verb was present – **Experiment 1** aims to find further evidence for an illusion effect in production, using two different coding schemes for cloze responses
- Fortuin (2014) argues that *No X is too Y to Z* is a conventionalized construction that licenses the inverted meaning – **Experiment 2** also investigates closely related constructions

EXPERIMENT 1 – DESIGN

- Single factor design: Double negation (DEPTH CHARGE) versus single negation (CONTROL)

Global negation, Adjectival negation (DEPTH CHARGE)

Keine	Kopfverletzung	ist	zu	ungefährlich,	um …
No	head injury	is	too	un-dangerous	to

No global negation, Adjectival negation (CONTROL)

Manch	eine	Kopfverletzung	ist	zu	ungefährlich,	um …
Some	a	head injury	is	too	un-dangerous	to

- 32 items, 60 subjects
- Cloze response, preamble reading time, completion time recorded

Response coding

- Preambles are not shown to coders
- **Scheme A** (9 coders, 3 per list): Cloze response + template with singular subject, e.g. *A head injury → ignore it/treat it*

  Question: Is the subject considered to be of importance / consequence?

  → Matches intuition that the illusion only appears with 'negative' verbs (Wason & Reich, 1979; Cook & Stevenson, 2010; Kizach et al., 2015)

- **Scheme B** (12 coders, 4 per list): Cloze response + template without negation, quantification, e.g. *This head injury is too dangerous to be ignored / # be treated*

  Question: Is the sentence sensible?

  → Matches intuition that the illusion meaning is pragmatically normalized, negations ignored

EXPERIMENT 1 – RESULTS

- Inter-coder agreement higher for Scheme A (Fleiss' κ: 0.77, 'substantial agreement') than for Scheme B (Fleiss' κ: 0.49, 'moderate agreement')
- Scheme A: Higher proportion of 'illusion' trials in DEPTH CHARGE versus CONTROL condition ($b = \mathbf{0.77}$, CrI: [0.65, 0.86])
- Scheme B: Higher proportion of 'illusion' trials in DEPTH CHARGE versus CONTROL condition ($b = \mathbf{0.67}$, CrI: [0.51, 0.78])
- Posterior means in DEPTH CHARGE condition:
  - Scheme A: **0.78**, CrI: [0.66, 0.86] – Scheme B: **0.74**, CrI: [0.62, 0.82]
- No evidence of condition affecting reading or completion times

EXPERIMENT 2 – DESIGN

- 3 × 2 design: CONSTRUCTION (3 levels) × NEGATION (2 levels)

Global negation, Adjectival negation (DEPTH CHARGE)

Keine	Kopfverletzung	ist	zu	ungefährlich,	…
No	head injury	is	too	un-dangerous	

No global negation, Adjectival negation (CONTROL)

Manch	eine	Kopfverletzung	ist	zu	ungefährlich,	…
Some	a	head injury	is	too	un-dangerous	

TOO . . . TO

um	ignoriert	zu	werden.	
to	ignored	to	get	

TOO . . . AS THAT

als	dass	man	sie	ignorieren	könnte.
as	that	one	it	ignore	could

SO . . . THAT

Global negation, Adjectival negation (DEPTH CHARGE)

Keine	Kopfverletzung	ist	so	ungefährlich,	…
No	head injury	is	so	un-dangerous	

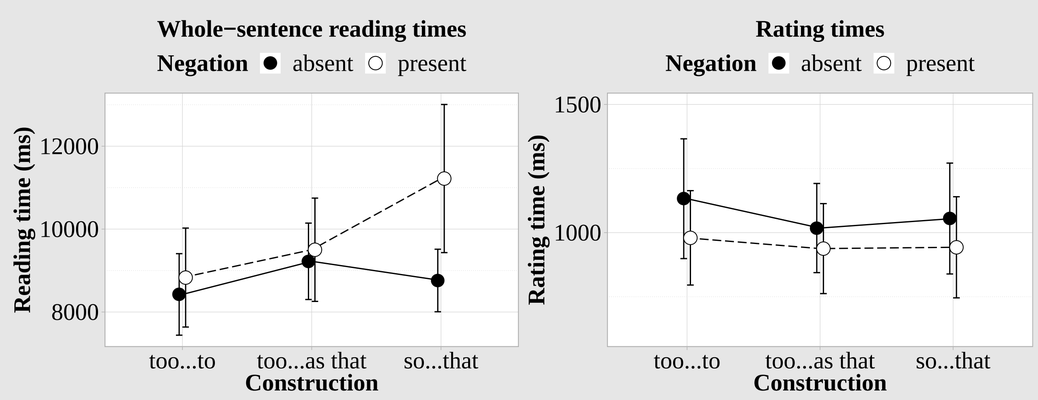
No global negation, Adjectival negation (CONTROL)

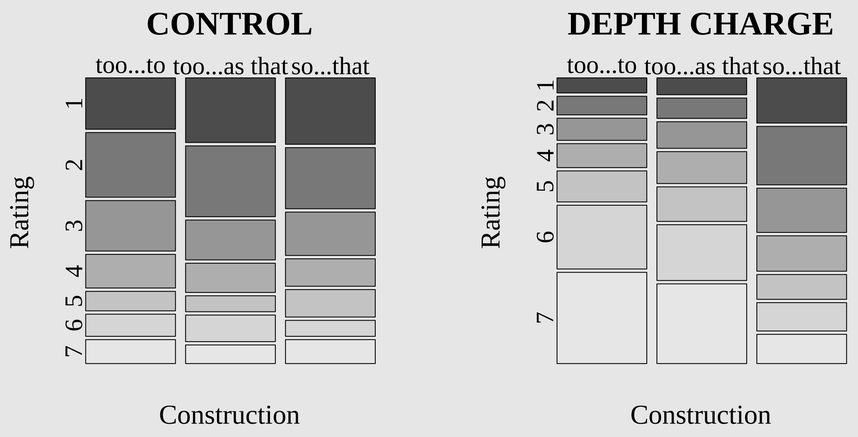
Manch	eine	Kopfverletzung	ist	so	ungefährlich,	…
Some	a	head injury	is	so	un-dangerous	

dass	sie	nicht	ignoriert	werden	sollte.
that	it	not	ignored	get	should

- 30 items, 60 subjects
- Whole-sentence reading time, rating time, sensibleness rating (1-7 scale) recorded

EXPERIMENT 2 – RESULTS





- **Reading times**: Compared to *too . . . to*, increased for *too . . . as that* ($b = \mathbf{757}$ ms, CrI: [352 ms, 1209 ms]) and *so . . . that* ($b = \mathbf{1144}$ ms, CrI: [698 ms, 1634 ms]); *so . . . that* × negation interaction ($b = \mathbf{969}$ ms, CrI: [195 ms, 1754 ms])
- **Sensibleness ratings**: Higher in DEPTH CHARGE condition for baseline *too . . . to* construction ($b = \mathbf{3.12}$, CrI: [2.54, 3.62]); compared to *too . . . to*, lower for *too . . . as that* ($b = \mathbf{-0.36}$, CrI: [−0.69, −0.02]) and *so . . . that* ($b = \mathbf{-1.44}$, CrI: [−1.78, −1.08]); *so . . . that* × negation interaction ($b = \mathbf{-2.5}$, CrI: [−3.13, −1.82])

DISCUSSION

- **Experiment 1** suggests that the verb is not the trigger of the depth charge illusion
- **Experiment 2** suggests that the illusion generalizes to related constructions, as long as the particle *too* is present
- **Proposal**: Illusion may be due to interpreting either too many (*too un-dangerous to not ignore*) or too few (*un-dangerous enough to ignore*) negations in the presence of implicit negation (*too X to Y* → not Y)

References. Cook & Stevenson (2010). *ACL P*, 61–69. Fortuin (2014). *Cogn Linguist*, 45(2), 249–292. Kizach, Christensen, & Weed (2016). *J Psycholinguist Res*, 45(3), 753–768. O'Connor (2015). *USC dissertation.* Paape & Vasishth (2017). *CUNY poster*. Wason & Reich (1979). *Q J Exp Psychol*, 31(4), 591–597.