

Double licensing of NPIs and inferential reasoning: an experimental study

Background. Negative Polarity Items (NPIs) are often seen as markers of downward inferences (DIs) Ladusaw (1979). However, experimental evidence for this claim is mixed. While Szabolcsi et al. (2008) found no support, later studies (Chemla et al., 2011; Denić et al., 2021) suggested some relationship based on subjective judgments of experimental subjects and aggregated NPIs/Positive Polarity Items licensing patterns w.r.t. inferences. We present new evidence focusing on double licensing (DL) of NPIs in Czech, examining whether NPIs in DL environments correlate with the facilitation of downward inferences. A positive result would support the DIs-NPIs link, consistent with experimental findings (Denić et al., 2021) and theoretical frameworks (Ladusaw, 1979; Kadmon and Landman, 1993; Chierchia, 2013). Conversely, a negative result would provide empirical support for theories that separate NPI licensing from DIs (Giannakidou, 1998; Zwarts, 1995; Barker, 2018), aligning with Szabolcsi et al.'s experimental results, albeit in different environments.

Experiment. We chose DL environments because NPI licensing varies in such contexts (Homer, 2021), despite being intuitively upward entailing. DL often fails when licensors are syntactically close (Mayer et al., 2019). We conducted two experiments: Experiment 1 tested NPI licensing (1×3 design: **BASELINE**, **DOUBT-NEG**, **NEG-DOUBT**; see (1)), and Experiment 2 tested inference reasoning (2×2 design: **DE-DOWN**, **DE-UP**, **UE-DOWN**, **UE-UP**; see (2)). Both were acceptability judgment tasks on a 7-point Likert scale, administered online via *L-Rex* with 57 native Czech speakers. We constructed two versions with reversed order to control for order effects.

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| <p>(1)a. Policie nemá <i>sebemenší důvod</i> tu
Police neg-have.3sg slightest reason that.acc
stopu zahladit.
trail.acc cover.
'The police have no reason to cover the trail.'BASELINE</p> <p>b. Petr pochybuje, že policie nemá
Petr doubts that police neg-have.3sg
<i>sebemenší důvod</i> tu stopu zahladit.
slightest reason that.acc trail.acc cover.
'Petr doubts that the Police have no reason to cover the trail.'DOUBT-NEG</p> <p>c. Petr nepochybuje, že policie má
Petr neg-doubts that police have.3sg
<i>sebemenší důvod</i> tu stopu zahladit.
slightest reason that.acc trail.acc cover.
'Petr does not doubt that the Police have the slightest reason to cover the trail.'NEG-DOUBT</p> | <p>(2)a. Petr pochybuje, že si
Petr doubts that SE
Marie nepořídila kočku.
Marie neg-buy.3sg cat.acc.
'Peter doubts that Marie didn't get a cat.'
(i) → siamese cat DE-DOWN
(ii) → animal DE-UP</p> <p>b. Petr nepochybuje, že si
Petr neg-doubts that SE
Marie pořídila kočku.
Marie buy.3sg cat.acc.
'Petr does not doubt that Marie has got a cat.'
(i) → siamese cat UE-DOWN
(ii) → animal UE-UP</p> |
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Results. We analyzed data using Bayesian linear regression (*rstanarm* (Brilleman et al., 2018), *R* (R Core Team, 2021)) with full random effects. Version order showed no credible effects, so data were aggregated. For Experiment 1, comparing DL environments with **BASELINE**: **BASELINE** was rated more natural ($\hat{\beta} = 2.46$, 95% CrI=[2.19, 2.73], BF=1.01e+18), while **NEG-DOUBT** was rated less natural than the **DOUBT-NEG** reference level (**DOUBT-NEG**: $\hat{\mu} = 4.40$, CrI=[4.02, 4.77]; **NEG-DOUBT**: $\hat{\beta} = -1.98$, CrI=[-2.26, -1.71], BF=2.25e+15). For Experiment 2, upward inferences were strongly preferred ($\hat{\beta} = 1.63$, CrI=[1.44, 1.81], BF=1.38e+16), with no environment effect ($\hat{\beta} = 0.14$, CrI=[-0.05, 0.33], BF=0.044), but a weaker interaction ($\hat{\beta} = 0.45$, CrI=[0.26, 0.64], BF=96.47). We used sum coding: **INF** with levels **UP** and **DOWN** for inferences and **ENV** for the negation position. See Figures 1-4.

Discussion. Experiment 1 results support domain-based NPI licensing Homer (2021): DL is acceptable when the NPI and licensor share a domain (**DOUBT-NEG**), but not when both licensors are in one domain and the NPI in another (**NEG-DOUBT**). However, Experiment 2 shows inferences are domain-insensitive: upward inferences were preferred regardless of whether DL spanned two clauses (**DE-UP,DE-DOWN**) or oc-

curred in the root (**UE-UP,UE-DOWN**). The extremely strong BF for the main effect of **INF** ($1.38e+16$) indicates that NPI licensing in DL environments doesn't correlate with DI facilitation, confirming Szabolcsi et al. (2008). This supports the view that NPIs signal narrow scope w.r.t. their licenser Barker (2018). In such a theory, for DL like (1-b), the licensing domain is the embedded clause where the wide scope interpretation ($\exists[REASON(x) \wedge \neg POLICECOVERS(x)]$) fails to entail the narrow scope ($\neg\exists[REASON(x) \wedge POLICECOVERS(x)]$). Since NPIs mark narrow scope domain-wise, they aren't reliable signals of inferences. We found no credible (per subject) correlation between NPI licensing and inferences (unlike Denić et al. (2021)). The extremely strong BFs for **DOUBT-NEG** vs. **NEG-DOUBT** and for **INF** in Experiment 2, contrasted with the weaker interaction (BF=96.47), suggest NPIs are grammaticalized in DI environments (Herburger, 2023) but DI is not synchronically necessary. The interaction may reflect minor evidence for the DIs-NPIs link or remnants of diachronic change (Herburger, 2023) but otherwise, our experimental results support theories of NPIs that separate NPI licensing from downward inferences (Barker, 2018; Giannakidou, 1998; Zwarts, 1995). Now we are finishing a follow-up experiment testing whether the same non-correlation holds in non-monotonic contexts like the first argument of the quantifier *the most*. The results should be available by the time of the conference.

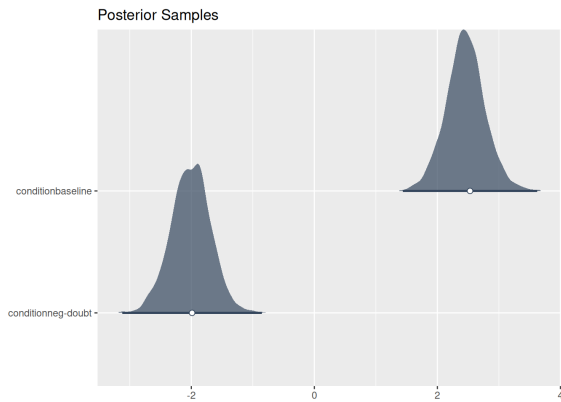


Figure 1: Posterior distribution: NPIs licensing in DL environments, exp 1

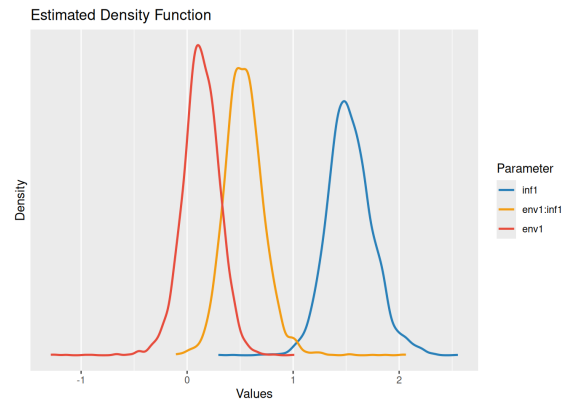


Figure 2: Posterior distribution: inferences in DL environments, exp 2

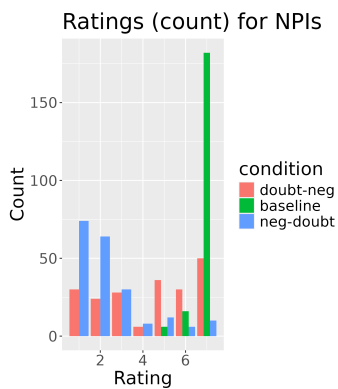


Figure 3: Ratings of NPIs licensing in DL envs, exp 1

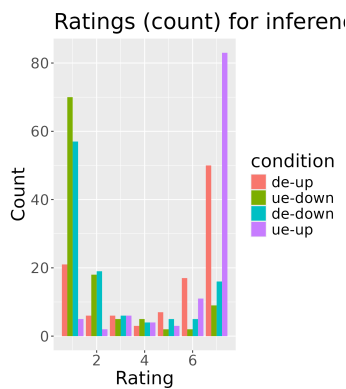


Figure 4: Ratings of inferences in DL envs, exp 2

Selected references: Barker, C. (2018). Negative polarity as scope marking. *L&P* 41(5), 483–510. ◇ Chemla, E., V. Homer, and D. Rothschild (2011). Modularity and intuitions in formal semantics. *L&P* 34, 537–570. ◇ Denić, M., V. Homer, D. Rothschild, and E. Chemla (2021). The influence of polarity items on inferential judgments. *Cognition* 215, 104791. ◇ Herburger, E. (2023). On the history of npis and negative concord. *Canadian Journ. of Ling.* 68(4), 555–589. ◇ Homer, V. (2021). Domains of polarity items. *JoS* 38(1), 1–48. ◇ Ladusaw, W. A. (1979). *Polarity Sensitivity as Inherent Scope Relations*. Ph.D. thesis. ◇ Szabolcsi, A., L. Bott, and B. McElree (2008). The effect of negative polarity items on inference verification. *JoS* 25(4), 411–450.

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