

## I. Background

**Negative Polarity Items (NPIs):** Words such as *ever, any*.

They need to occur in licensing contexts (within the scope of negation) as in (1). Otherwise, their use is ungrammatical as in (1\*).

(1/1\*) a. John *hasn't*\**has ever* been to Istanbul.

NPI licensing involves (long-distance) dependency between the licensor and the NPI.

Mostly examined within the context of memory retrieval as they involve dependency resolution.

- **Memory retrieval (Lewis & Vasishth, 2005):** When an NPI is encountered, a previously encountered licensor must be retrieved from memory.

**Deniz et al. (2024):** In Turkish, a head-final language, their processing involves prediction for a governor (licensor) (**Surprisal; Hale, 2006; Levy, 2008**)

The more predictable the licensor, the easier to resolve the dependency.

- Complex sentences with NPIs in embedded clauses (EC), with either local or matrix verb (MV) licensors
- Manipulated morpho-syntax at EC verb and semantics at MV. (see 2 below)

**Results:**

- Turkish speakers used the EC verb morphology to predict long-distance licensing
- They used semantic information associated with the matrix verb
- There was (retroactive) interference in acceptability judgments but not in eye-movements

## 2. The Present Study

Extends Deniz et al. (2024) to second language (L2) processing.

Examines if

- L2 speakers of Turkish would also use EC morphology to predict long-distance licensing of NPIs in Turkish
- their processing would be more vulnerable to interference (Cunnings, 2017)

Two experiments → Expt 1: eye-tracking-while-reading, Expt 2: acceptability judgment

## 3. (Long-Distance) NPI Licensing in Turkish

**Syntactic constraints:**– NPIs must be licensed locally within the scope of a c-commanding negation marker -- When they occur in embedded clauses (ECs), they can, sometimes, be long-distance licensed by the matrix verb.  
-- Long-distance licensing is subject to the embedded clause (EC) structure.

**Transparent domain:** If EC is not marked for tense, aspect and factivity as in (2a), it forms a transparent domain which allows for long-distance (matrix verb) licensing of an embedded NPI

**Opaque domain:** If EC is marked for tense, agreement and factivity as in (2b), it forms an opaque domain which prevents long-distance (matrix verb) licensing

(Kornfilt, 1984; 2007)

- (2) a. **Transparent EC:** Ali [hiç kimse-nin geç kal-*ma*-sin-i] iste-me-di.  
Ali any body-GEN late stay-NOM-3SG.POSS-ACC want-NEG-PAST  
Ali did not want anybody to be late.
- b. **Opaque EC:** \*Ali [hiç kimse-nin Ayşe-yi sev-diğ-in-i] hatırla-ma-dı.  
Ali any body-GEN Ayşe-ACC like-FN-3SG.POSS-ACC remember-NEG-PAST  
Ali did not remember that anybody liked Ayşe.

**Semantic factors:** An EC NPI can be long-distance (matrix verb) licensed if the matrix verb is a neg(ative)-raising verb.

**Neg-raising verbs:** Matrix verb negation can extend its scope to EC with verbs such as *think*

- (3) I *don't think* he is coming.  
(i) I *do not think* he is coming.  
(ii) I *think* he is *not coming*.

(Horn, 1978;1995)

## 4. Stimuli: [Subject [Subject + NPI + embedded VP] matrix VP]

Materials: 60 sentences with 12 conditions selected in a normative study (ensuring transparent/opaque EC unbias) → 3 factors:

- **Licensing:** *Locally licensed (LL), Long-distance licensed (LDL), Unlicensed (UL)*
- **EC structure:** *Transparent (-mA) or Opaque (-AcAK) domain*
- **Matrix verb type:** *Neg-raising (NR) or non-neg-raising (NNR) matrix verb*

(4) (Negation suffix –mA (subject to vowel harmony) underlined.)

- NR **Transparent**
- LL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-ma-sin-i] muhtemelen um-uyor-du ...
  - LDL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-sin-i] muhtemelen um-*mu*-yor-du ...
  - UL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-sin-i] muhtemelen um-uyor-du ...
- Opaque**
- d. LL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-yacağ-in-i] muhtemelen um-uyor-du ...
  - e. LDL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*yacağ*-in-i] muhtemelen um-*mu*-yor-du ...
  - f. UL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*yacağ*-in-i] muhtemelen um-uyor-du ...  
Mr. Hasan probably (did not) hope(d) that the secretary would call anyone beforehand.

- NNR **Transparent**
- g. LL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-ma-sin-dan] muhtemelen yakın-iyor-du
  - h. LDL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-sin-dan] muhtemelen yakın-*mi*-yor-du ...
  - i. UL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-sin-i] muhtemelen yakın-iyor-du ...
- Opaque**
- j. LL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*ma*-yacağ-in-dan] muhtemelen yakın-iyor-du
  - k. LDL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*yacağ*-in-i] muhtemelen yakın-*mi*-yor-du
  - l. UL Hasan Bey [sekreter-in hiç kimse-yi önceden ara-*yacağ*-in-dan] muhtemelen yakın-iyor-du ...  
Mr. Hasan probably (did not) complain(ed) that the secretary would call anyone beforehand.

## 5. Experiment 1 – Eye-tracking-while-reading

**Materials:** 60 sentences as in (4), each with 12 versions.

A content-neutral word (bence “in my opinion”) followed matrix verb to prevent wrap-up effects.  
96 grammatical fillers (24 control fillers with/without negation marking on the embedded or matrix verb)

**Participants:** 72 native speakers of Turkish  
54 L2 speakers of Turkish with head-initial LIs.  
(data collection in progress)

**Procedure:** Read the sentences silently & answer comprehension questions  
EyeLink 1000 Plus to track eye-movements

EyeLink 1000 Plus to track eye-movements

**Critical regions:** EC verb (6<sup>th</sup> word) and its spillover & Matrix verb (8<sup>th</sup> word) and its spillover

## 7. Experiment 1 - Results

Complex models with Group better than simpler models across all regions and measures ( $\chi^2$ s = 3.98–62.47,  $df$  = 1–19,  $p$ 's ≤ .046)

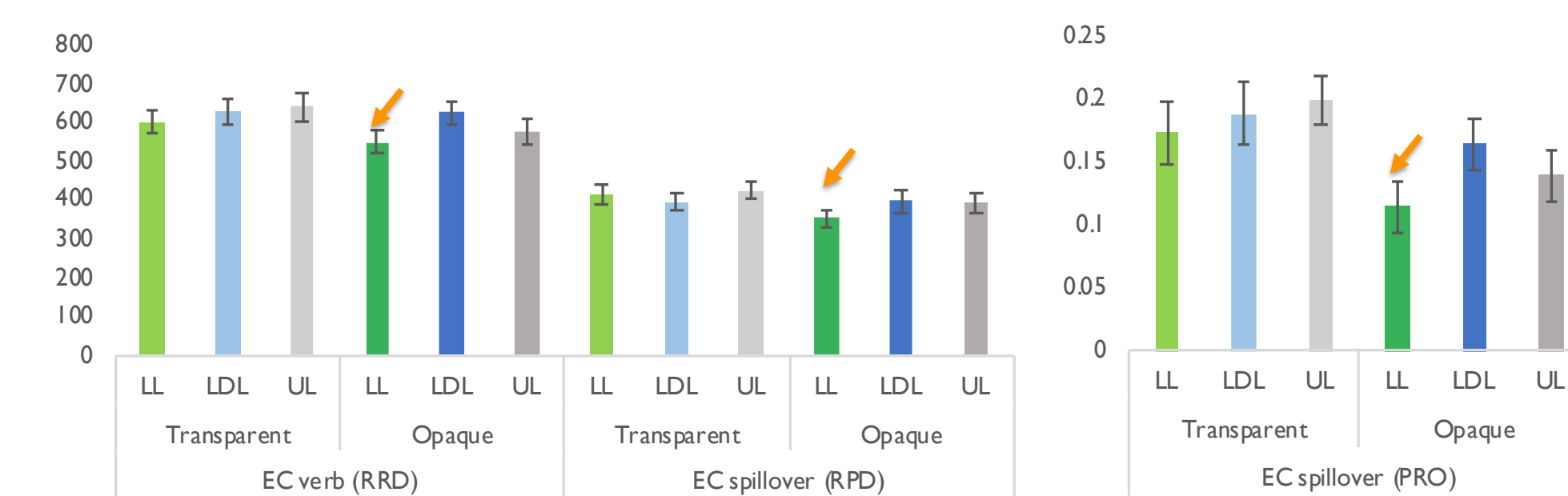
### 7.1. L1 Results (reported in Deniz et al., 2024)

**EC Verb & its spillover:**

**Transparent > Opaque** (for RRD at EC verb and GD, RPD, TD and PRO at spillover)

**EC structure \* licensing** (for RRD at EC verb & RPD and PRO at spillover)

\*  $\left\{ \begin{array}{l} \text{Transparent: Local L} = \text{Long-Distance L} = \text{UnL} \\ \text{Opaque: Local L} < \text{Long-Distance L} = \text{UnL} \end{array} \right\}$  ( $\theta$ 's ≥ 29.7,  $t$ 's ≤ 1.30,  $p$ 's ≥ .20)  
( $\theta$ 's ≥ 56.4,  $t$ 's ≥ 1.94,  $p$ 's < .05)



➢ **Supports expectation-based parsing:**

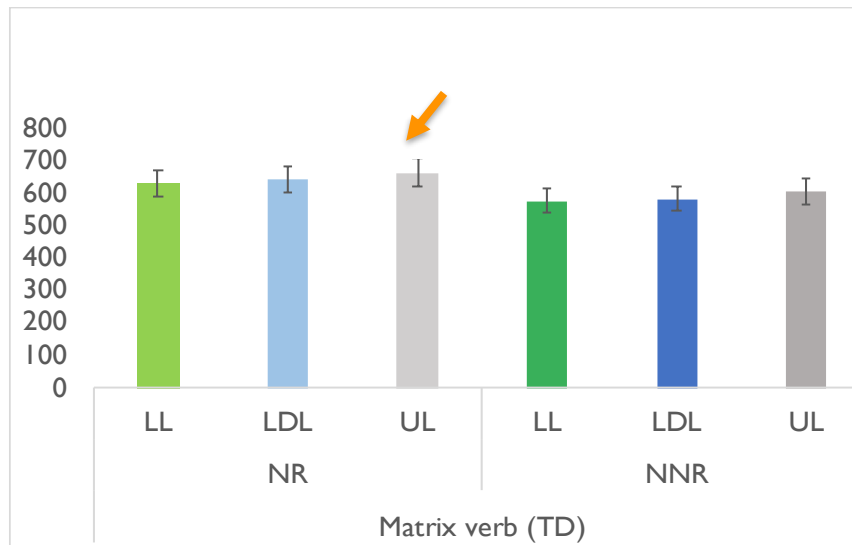
- In **transparent:** Long-distance licensing was predicted (transparent > opaque despite simpler syntax)
- In **opaque:** grammaticality was judged at the EC verb

**Matrix Verb & its spillover:**

**Neg-raising > Non-neg-raising** (for GD, RPD, RRD and TD on matrix verb)

**Neg-raising \* licensing** for TD at matrix verb ( $\chi^2$ s = 28.36)

\*  $\left\{ \begin{array}{l} \text{Neg-raising: Local L} = \text{Long-Distance L} < \text{UnL} \\ \text{Non-neg-raising: Local L} = \text{Long-Distance L} = \text{UnL} \end{array} \right\}$  ( $\theta$  = 44.5,  $t$  = 2.14,  $p$  < .05)  
( $\theta$  = 24.1,  $t$  = 1.28,  $p$  = .20)



➢ **Also supports expectation-based parsing:**

- Long-distance = local L < UnL only in neg-raising

## 8. Experiment 2 – Acceptability Judgment

**Materials:** Same as in Experiment 1.

26 ungrammatical & 72 grammatical fillers (proportional to critical items)

**Participants:** 56 L1 speakers of Turkish  
34 L2 speakers of Turkish  
(data collection in progress)

**Analysis:** Mixed effects logistic regression with *ordinal* package

**Procedure:** Rated the sentences on a scale of 1 to 7 (acceptable) on PCibex

**Table 1.** Means and standard errors (SE) for the acceptability ratings for L1 and L2 groups

	L1						L2					
	Transparent			Opaque			Transparent			Opaque		
	LL	LDL	UL	LL	LDL	UL	LL	LDL	UL	LL	LDL	UL
NR	5.13 (.11)	2.84 (.12)	1.14 (.09)	4.78 (.12)	5.33 (.11)	3.16 (.12)	4.47 (.12)	4.34 (.12)	3.74 (.12)	4.78 (.12)	4.29 (.12)	3.69 (.12)
NNR	5.76 (.10)	2.73 (.11)	2.29 (.10)	5.72 (.10)	2.53 (.11)	2.02 (.08)	4.61 (.12)	3.86 (.12)	3.89 (.12)	4.89 (.12)	4.21 (.11)	3.77 (.12)

For both groups & for all conditions

\*  $\left\{ \begin{array}{l} \text{Local L} > \text{Long-Distance L} > \text{Unlicensed} \\ \text{Neg-raising} > \text{Non-neg-raising} \end{array} \right\}$  ( $\theta$ 's ≥ .35,  $z$ 's ≥ 2.26,  $p$ 's < .05)

Same pattern in grammatically and syntactically illicit conditions (Opaque & Non-NegRaising)

→ **grammaticality illusion** (retroactive intrusion)

For L2: Ratings overall regressed to the mean → less confidence?

## References & Acknowledgements

**Hale, J. (2005).** Cognitive Science, 30(4), 643-672. **Horn, L.R. (1978).** Remarks on neg-raising, Academic Press. **Horn, L. R. (1995).** A Natural History of Negation. CUP. **Kornfilt, J. (1984).** Case marking, agreement, and empty categories in Turkish, Harvard University. **Kornfilt, J. (2007).** In *Fineness: Theoretical and empirical foundations*, 305-332. **Levy, R. (2008).** Cognition, 106(3), 1126-1177. **Lewis & Vasishth (2005).** Cognitive Science, 29, 375-419. **Deniz et al. (2024).** Effects of surprisal in (long-distance) licensing of Turkish NPIs. 37<sup>th</sup> HSP Conference, Michigan, USA.

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## 6. Experiment 1 – Data Analysis

**Data cleaning:** fixations < 80 ms merged with nearby fixations (1 degree visual angle)  
fixations < 80 ms, > 800 ms eliminated

**Data analysis:** Mixed effects linear/logistic regression with *lmer* package  
*fixed factors:* *group (L1, L2)*  
licensing (locally licensed, long-distance licensed, unlicensed),  
EC structure (transparent & opaque)  
matrix verb type (neg-raising & non-neg-raising)

*random factors:* subjects, items

*measures:* five standard eye-tracking measures  
(gaze duration (GD), regression path duration (RPD), re-reading duration (RRD), total duration (TD) and probability of regression out (PRO))

### 7.2. L2 Results (new data)

**EC Verb & its spillover:**

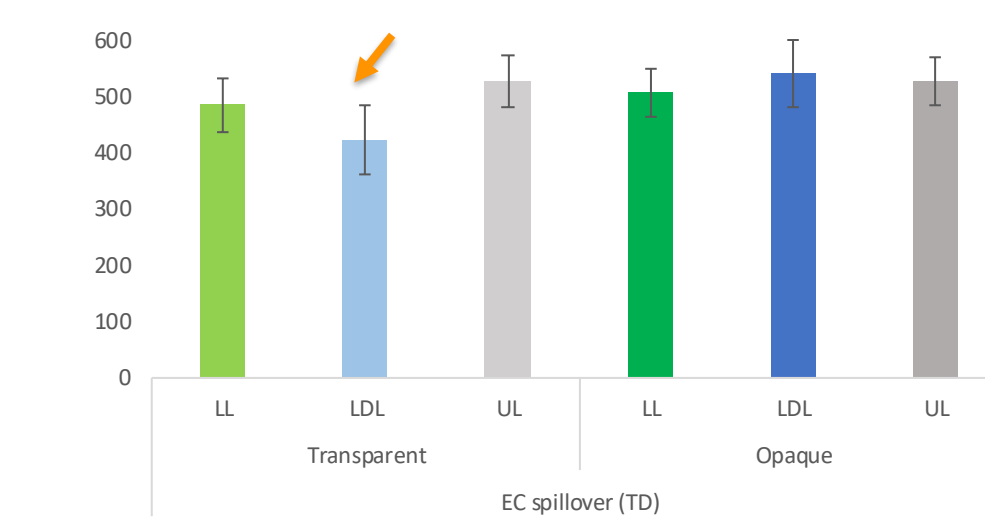
**Transparent < Opaque** (for TD at EC verb)

**Licensing**

$\left\{ \begin{array}{l} \text{Local L} > \text{Long-Distance L} = \text{UnL} \\ \text{Long-distance L} > \text{Local L} = \text{UnL} \\ \text{Local L} = \text{Long-Distance L} < \text{UnL} \end{array} \right\}$  (for GD, RPD at EC verb & GD at spillover) ( $\theta$  ≥ 36.1,  $t$ 's ≥ 1.96,  $p$ 's ≤ .05)  
(for TD at EC verb) ( $\theta$  = 208,  $t$  = 3.33,  $p$  < .005)  
(for RRD at spillover) ( $\theta$  = 47.8,  $t$  = 2.73,  $p$  < .01)

**EC structure \* licensing** (for TD at EC spillover)

\*  $\left\{ \begin{array}{l} \text{Transparent: Local L} = \text{Long-Distance L} < \text{UnL} \\ \text{Opaque: Local L} = \text{Long-Distance L} = \text{UnL} \end{array} \right\}$  ( $\theta$  = 113.5,  $t$  = 2.6,  $p$  < .05)  
( $\theta$ 's ≥ 36.1,  $t$ 's ≤ .62,  $p$ 's ≥ .69)



➢ **No evidence of expectation-based parsing**

- L2ers did not use EC morpho-syntax to make decisions for (local) licensing / grammaticality at EC verb

➢ **Support for memory retrieval**

- Long-distance licensing easier for transparent ECs

**Matrix Verb & its spillover:**

**Neg-raising > Non-neg-raising** (for RRD on matrix verb)

**Licensing**

$\left\{ \begin{array}{l} \text{Long-distance L} < \text{Local L} = \text{UnL} \\ \text{Local L} < \text{Long-Distance L} = \text{UnL} \\ \text{Local L} = \text{Long-Distance L} < \text{UnL} \end{array} \right\}$  (for RPD at matrix verb) ( $\theta$  = 193.5,  $t$  = 5.3,  $p$  < .001)  
(for PRO at matrix verb) ( $\theta$  = .34,  $z$  = 2.22,  $p$  < .05)  
(for RPD, PRO at spillover) ( $\theta$ 's = 190.24/31,  $t$ 'z = 3.15/2,  $p$ 's < .05)

**Neg-raising + EC Structure + Licensing** (for GD on matrix verb)

\*  $\left\{ \begin{array}{l} \text{Neg-raising} > \text{non-neg-raising} \\ \text{Transparent} > \text{opaque} \\ \text{Long-Distance L} < \text{Local L} = \text{UnL} \end{array} \right\}$  ( $\theta$  = 57.4,  $t$  = 1.97,  $p$  < .05)  
( $\theta$  = 54.1,  $t$  = 1.9,  $p$  = .06)  
( $\theta$  = 95.4,  $t$  = 2.7,  $p$  < .005)

➢ **Support for memory retrieval**

- Long-distance licensing for Neg-raising verbs (matrix verb semantics) and transparent ECs (EC morpho-syntax)

➢ **Mixed results for licensing**

- Licensed (local or long-distance) takes longer than unlicensed in early and some late measures
- Licensed takes shorter than unlicensed in later measures
  - L2ers ignore ungrammaticality first to resolve the dependency and attend to ungrammaticality during revision??

## 9. Discussion

**Eye-tracking data:**

- **L1 speakers rely on expectation-based parsing in (long-distance) licensing of Turkish NPIs; they do not engage in memory-retrievals**

- ❖ They used EC verb morphology to predict long-distance licensing of NPIs.
  - ❖ In ECs with opaque domain: Grammaticality was judged at the EC verb.
  - ❖ In ECs with transparent domain: Grammaticality was not judged at the EC verb.
- ❖ No effect of EC structure at matrix verb

- **L2 speakers of Turkish, at least those with head-initial LIs, do not engage in expectation-based parsing; they rely on memory-retrievals**

- ❖ They used EC structure at matrix verb together with verb type for long-distance licensing
- ❖ They used EC morpho-syntax (TD) for long-distance licensing

- **Conclusion:** L1 and L2 processing of NPI licensing rely on different mechanisms w.r.t. general parsing operations, which goes beyond differential cue-weighting (Cunnings, 2017; Deniz, 2022)

**Acceptability judgment data:**

- Support for grammaticality illusion, suggesting retroactive intrusion, in judgments in L1 & L2
  - ❖ Local L > Long-Distance L > UnL in ungrammatical conditions (NNR & Opaque) as well as semantically (NR) or syntactically licit (Transparent) ones.

**Limitations:** Results are preliminary – further data are collected in both groups.

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