Not *All* the Interpretations Work for *Every* Sentence: A Study on the Processing of Italian "Tutti" and "Ogni"

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Unlike typical nouns, the meanings of quantifiers are not associated with a referent in a conceptual world; instead, quantifiers provide information for speakers to establish how many entities or events are involved in an utterance. Two widely used terms are “universal quantifier” (e.g., English *all*, *every*) and “existential quantifier” (e.g., English *some*, *a*). Doubly quantified sentences like ‘Every child climbed a tree’ can be ambiguous (Raffray & Pickering, 2010) in expressing either the surface scope (i.e., *every* > *a*, as in ‘different trees were climbed by different children’) or the inverse scope (i.e., *a* > *every*, as in ‘one single tree was climbed by every child’). Many theoretical and experimental theories are proposed to account for the interaction of scope readings of different quantifiers in a sentence, and only a few studies focused on the preferred or dominant interpretation that these quantifiers have (Kurtzman & MacDonald, 1993; Feiman & Snedeker, 2016). Furthermore, most works were on English.

In this study, first, we aim to establish a baseline understanding of the scope preferences of the Italian quantifiers “*tutti”* ("all") and “*ogni”* ("every") (cf. Ioup, 1975). We also examine how doubly quantified sentences (*Every … a ….*) are processed in Italian and whether implicit semantic facilitation occurs for surface or inverse scope readings, as well as for collective and distributive interpretations. Using PCIbex, we collected data from 40 native Italian speakers using a cumulative-window, word-by-word self-paced paradigm for a sentence verification task. Participants rated, on a scale of 1 to 7, how well the second sentence (target) interpreted the first one (context) in 35 pairs of sentences. The context sentences featured two conditions: **ALL** (“*Tutti”* / “*Tutte*” in Italian), and **EVERY** (“*Ogni*” in Italian). The quantifiers modified the subject of the context stimuli, followed by an existential singular direct object presented with “*un/o/a*”. Based on previous literature, we expect ALL context to favor collective reading, and EVERY context to be ambiguous between collective or distributive readings. The target sentences were expected to describe either explicit distributive (**DIST**, with “*ognuno/a*” (“each”)) or collective (**COLL**, with “*stesso/a*” (“the same”)) readings of the contexts (Table1). Participants’ reading time (RTs) of each word in the context-target pairs and their ratings were recorded. We focused on the sentences’ mean overall RTs of target sentences, their last word RTs, and RTs of three regions in the target sentences, i.e., the three words following the main verb. We use linear mixed-effect models to analyze RTs and cumulative link mixed models for ratings.

Target sentences following ALL had shorter RTs in regions 6 and 7, and shorter mean overall RT (*p*s < .0001) (Table 2). DIST targets following EVERY contexts had a shorter overall mean RT than COLL targets in the same context ($p < .0001$). Conversely, COLL targets following ALL had a shorter overall mean RT than DIST targets in the same context ($p < .0001$). As shown in Fig. 1, upon reading the direct object (R6), where the distributive pronoun “*ognuno/a*” or the determiner preceding the collective adjective “*stesso/a*” appeared, ALL-COLL was read significantly faster than ALL-DIST ($p = .004$). In region 7, the only significant difference was between ALL-COLL and EVERY-COLL ($p < .0001$), with the former yielding shorter RTs. Finally, at the last word (R8/9), ALL-COLL had shorter RTs than ALL-DIST ($p = 0.0002$) and EVERY-COLL ($p = 0.0001$).

Considering the interpretations, participants rated EVERY-DIST the highest, followed by ALL-DIST, ALL-COLL, and finally EVERY-COLL. All the differences between condition combinations were significant (*p*s < .0001), except between ALL-COLL and ALL-DIST. This suggests that while sentences beginning with “*tutti/e”* (“all”) facilitated the processing of subsequent sentences, readers tend to prefer collective interpretations of such ALL sentences and a distributive interpretation of sentences beginning with “*ogni”* (“every”). These preferences emerged despite the absence of semantic or grammatical clues favoring distributive or collective readings of the quantifier sentences.

Notably, despite the significant differences in mean overall RTs and ratings, EVERY contexts did not lead to significant facilitation in processing internal regions of DIST target sentences, as the ALL contexts did for COLL targets. This suggest that, while the dominant collective preference in ALL sentences was consistent, EVERY sentences containing an existential object introduce some ambiguity during language comprehension.

CONTEXTS	
ALL	Tutte le scimmie hanno afferrato una pesca. '*All the monkeys have grabbed a peach.'*
EVERY	Ogni scimmia ha afferrato una pesca. '*Every monkey has grabbed a peach.'*
TARGETS	
DIST	Le tre scimmie hanno afferrato ognuna una pesca diversa. *'The three monkeys have grabbed each a different peach.'*
COLL	Le tre scimmie hanno afferrato la stessa pesca *'The three monkeys have grabbed the same peach.'*

***Table 1**: Example of context and target sentences in the four conditions.*

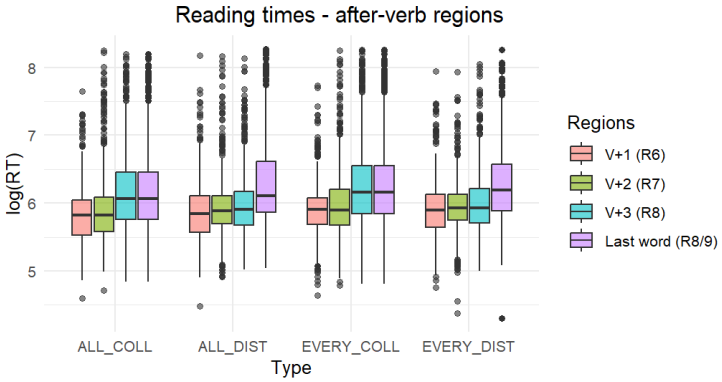

***Figure 2**: The logarithm of reaction times (RT) of regions following the main verb in target sentences.*

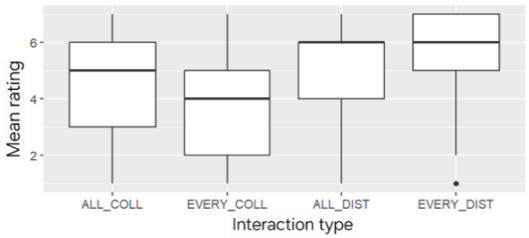

***Figure 1**: Mean ratings for each context-target condition combination.*

Variable	***Conditions compared***	***Estimates***	***p-value***
Mean overall context RT	ALL - EVERY	-0.09	<.0001
Mean overall target RT	ALL COLL – EVERY COLL	-0.07	<.0001
	ALL COLL – ALL DIST	-0.03	<.0001
	EVERY COLL – EVERY DIST	0.02	<.0001
	ALL DIST – EVERY DIST	-0.01	0.057
Region 6 RT	ALL COLL – EVERY COLL	-0.09	<.0001
	ALL COLL – ALL DIST	-0.65	0.004
	EVERY COLL – EVERY DIST	-0.006	0.988
	ALL DIST – EVERY DIST	-0.03	0.41
Region 7 RT	ALL COLL – EVERY COLL	-0.09	<.0001
	ALL COLL – ALL DIST	-0.03	0.307
	EVERY COLL – EVERY DIST	0.02	0.744
	ALL DIST – EVERY DIST	-0.41	0.135
Last Word (R 8/9) RT	ALL COLL – EVERY COLL	-0.12	0.0001
	ALL COLL – ALL DIST	-0.12	0.0002
	EVERY COLL – EVERY DIST	-0.02	0.95
	ALL DIST – EVERY DIST	-0.01	0.96
Ratings	ALL COLL – EVERY COLL	4.95 / 3.75 (1.194)	<.0001
	ALL COLL – ALL DIST	4.95 / 5.17 (-0.22)	0.05
	EVERY COLL – EVERY DIST	3.75 / 5.90 (-2.14)	<.0001
	ALL DIST – EVERY DIST	5.17 / 5.90 (-0.73)	<.0001

***Table 2**: Results based on estimated marginal means by variables and compared conditions.*

Selected references: Raffray, C. N., & Pickering, M. J. (2010). How do people construct logical form during language comprehension? *Psychological Science*, 21, 1090 –1097; Ioup, Georgette. (1975). Some universals for quantifier scope. In J. Kimball (Ed.), *Syntax and semantics* Vol. 4, 37–58. New York: Academic Press.