Integrating contextual information in on-line alternative set construction

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The interpretation of focus-sensitive particles like *only* in (1a) is widely understood to depend on a set of alternatives which can replace the expression in focus [1]: (1a) implies that Lily didn't eat any fruits besides apples. In constructing alternative sets (*alt-sets*) on-line, comprehenders are argued to use domain-general mechanisms to first activate a large cohort of expressions by spreading activation from the the focused expression to semantically associated ones. At a later stage, selection mechanisms distinguish contrastive, replaceable associates (*pears, mangos*) from non-contrastive associates (*cider*, *orchard*) by deactivating non-contrastive ones [2-4]. But the relevant alt-set is also contextually determined: (1b) suggests Lily didn't eat *any* food but apples. Visual world studies indeed show that together with associated alternatives, unrelated but explicitly mentioned alternatives are also facilitated [5]. Using on-line reading measures, this paper further investigates when comprehenders use different types of contextual information to correctly infer the alt-set in English: E1 replicated these findings in reading by showing that comprehenders quickly generate hypotheses about the alt-set based on contextual mention. E2 showed a delayed integration of more fine-grained contextual information which excludes expressions from the alt-set that are nevertheless salient and associated with the focus.

Exp1 (n=48) investigated whether alternatives can be facilitated due to contextual salience through explicit mention. 48 items like (2) were created, in which a context sentence manipulated Givenness of an alternative by either explicitly mentioning it or not (+/–GIVEN). The target sentence manipulated semantic Association of the alternative to the focus such that the focus is either associated with the subsequent alternative or not (+/–ASSOC). Association was determined throughout using Latent Semantic Analysis [6], where similarity of alternatives and foci was >0.4 in the +ASSOC condition, and <0.18 in the –ASSOC condition. Target sentences were presented using the Maze task [7-8], and relative activation and/or ease of integration of an alternative was measured in RTs on the ROI (indicated with pipes): If an alternative (*cheese*) becomes activated due to a preceding focus (*only milk*$_F$), we'd expect this expression to yield shorter RTs than unexpected and/or non-activated expressions. Bayesian mixed effects regressions in `brms` were fit to both logRTs (reported here) and raw data (Table 1-3) on the ROI and surrounding regions [9]. Only effects reliable in both are reported. **Results** Models revealed a main effect of Givenness (β=*.12; 95CrI=[.10, .14]*) and of Assoc(β=*.03; CrI=[.01,.04]*) on ROIs.

Exp2 investigated when contextual information about exclusion of alternatives from an alt-set is taken into consideration by crossing Association (+/–ASSOC) with Exclusion of alternatives (+/–EXCL). Two context sentences mentioned three alternatives but excluded one from the alt-set by ensuring that the presupposition of the matrix predicate in the target sentence (*remember to bring*) could not be satisfied and hence this alternative could not replace the focus. **E2a** (n=48) presented target sentences with short distances between focus and alternative using the Maze task, as in (3). **E2b** (n=48) uses identical materials but with a longer focus-alternative distance, as in (4). **Results** At the ROI, results of E2a only revealed a main effect of Association on log and raw RTs (β=*.03; CI=[.015, .046]*), but the CrI for Exclusion included zero for logRTs (β=*.02; CI=[-.001, .04]*). Results of E2b only revealed a main effect of Exclusion (β=*0.03; CI=[.016,.05]*), but not for Association. The CrI for the simple effect of Exclusion in +ASSOC conditions included zero in E2a but not in E2b (β=*.02; CI=[.04,.001]*). **In sum,** E1 showed that unassociated alternatives were facilitated when explicitly mentioned, suggesting that the initial priming mechanism relies on contextual salience as well as semantic association. E2 showed that context can rule out alternatives as part of the relevant alt-set despite them being both salient and associated with the focus, but that this type of contextual information is only reliably taken into account at a delay from the focus itself. Results are thus partially in line with two-stage models: They suggest that early activation of associated alternatives may temporarily override finer-grained context-specific preferences. Future work should determine what mechanism is used to exclude these globally appropriate, but contextually inappropriate alternatives.

(1) a. Usually, Lily eats lots of fruit, but today she ate only an apple$_F$. ⇝ *…but not any other fruit.*
b. Usually Lily likes her mom's cooking, but today she ate only an apple$_F$. ⇝ *…but not any of her mom's food.*

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(2) a. **Context:** The corner store sells various items, such as { **cheese** and **milk**, +GIVEN +ASSOC
cheese and **cigarettes**, +GIVEN –ASSOC
cigarettes and **milk**, –GIVEN +ASSOC
milk and **cigarettes** } –GIVEN –ASSOC
b. **Target:** Today they sold only { **milk**$^{+ASSOC}$ | **cigarettes**$^{–ASSOC}$ }, but no |**cheese**| even though…

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(3) a. **Context:** The tourist asked for a variety of items, like some **cheese** and **milk**.
There was already an **ashtray** on the table.
Target: When the waiter returned, he remembered to bring only **milk,** but no |**cheese**|... –EXCL +ASSOC SHORT
b. **Context:** The tourist asked for a variety of items, like some **cheese** and an **ashtray**.
There was already some **milk** on the table.
Target: When the waiter returned, he remembered to bring only an **ashtray,** but no |**cheese**|... –EXCL –ASSOC SHORT
c. **Context:** The tourist asked for a variety of items, like an **ashtray** and some **milk**.
There was already some **cheese** on the table.
Target: When the waiter returned, he remembered to bring only **milk,** but no |**cheese**|... +EXCL +ASSOC SHORT
d. **Context:** The tourist asked for a variety of items, like some **milk** and an **ashtray**.
There was already some **cheese** on the table.
Target: When the waiter returned, he remembered to bring only an **ashtray,** but no |**cheese**|... +EXCL –ASSOC SHORT

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(4) **Target:** …he remembered to bring only { **milk** | **ashtray** }, but he forgot to bring any |**cheese**|... LONG DISTANCE

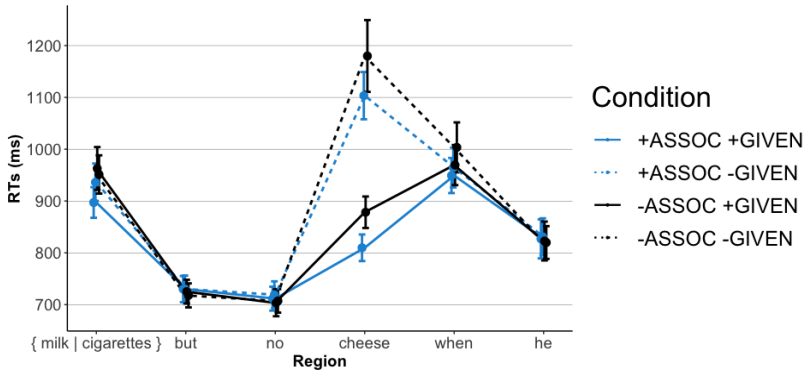

Figure 1: *RTs per region and condition of Exp1 (95%CIs)*

	Est	Error	95%CrI
Intercept	807.0	22.74	[753-860.2]
Assoc	68.5	30.07	[9.8-128.0]
Given	296.7	36.03	[227-368.5]
Ass x Giv	2.6	49.28	[-92.9-99.91]

Table 1: `brms` *results for raw RTs of Experiment 1*

	Est	Err	95%CrI
Intercept	1034	36.8	[960-1104]
Assoc	83.9	23.61	[37.1-130]
Exclusion	71.2	32.0	[7.66-134]
Assoc x Ex	33.7	36.7	[-39-107.5]

Table 2: `brms` *results for E2a*

	Est	Err	95%CrI
Intercept	998	29.6	[939-1054]
Assoc	36.0	19.9	[-2.8-74.4]
Exclusion	92.0	24.1	[45.7-141]
Assoc x Ex	75.0	39.3	[-3.1-155]

Table 3: *results for E2b*

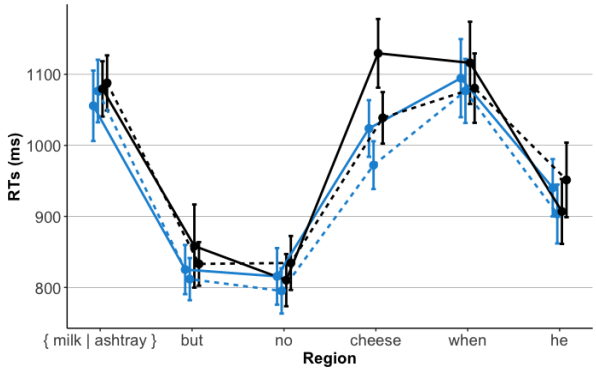

Figure 2a: *RTs per region and condition of Exp2a*

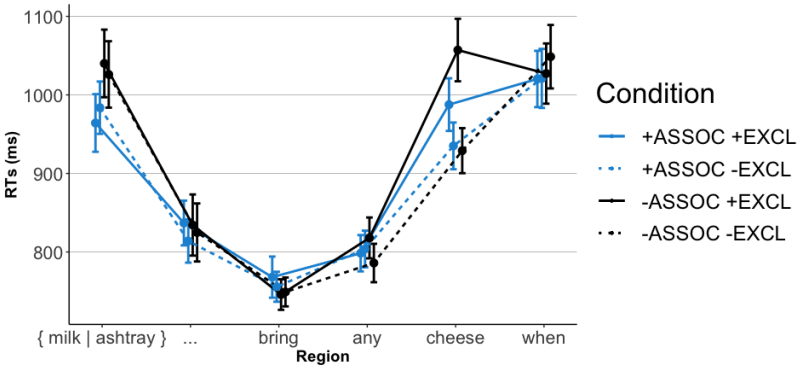

Figure 2b: *RTs per region and condition of Exp2b*

References **[1]** Rooth (1992). *Nat. Lang. Semantics*. **[2]** Braun & Tagliapietra (2010). *Lang. & Cog. Proc*. **[3]** Husband & Ferreira (2015). *Lang, Cog. & Neuroscience*. **[4]** Gotzner (2015). *Diss*. **[5]** Kim et al. (2015). *Cognition*. **[6]** Landauer et al. (1998). *Discourse Processes*. **[7]** Forster et al. (2009) *Behav. Res. Methods*. **[8]** Boyce et al. (2020) *JML*. **[9]** Bürkner (2017) *J. Stat. Soft*.