Appendix A. Target sentences

Mon père a expliqué que la bretelle passe sur l'épaule.
L'enfant a posé la cerise au sommet du gâteau.
J'ai vu que la cheminée produit beaucoup de fumée.
Le vendeur m'a dit que la chemise peut être combinée avec un nœud.
On a soigné le cheval à la fin du match.
Je sais que les cheveux sont ramassés par le coiffeur.
Il a acheté le chevalet pour appuyer sa peinture.
On trouve toujours la chenille dans les arbres.
On constate que la cheville a eu une fracture.
Des chercheurs ont démontré que la crevette peut vivre en dehors de l' eau.
Je sais que la fenêtre nous protège de la pluie.
On sait que le genou est sensible à cause d'une blessure.
J'ai appris de mon grand-père que la grenade est considerée comme une arme.
L'enfant a vu la grenouille au bord du lac.
Mon père m'a donné le jeton qui était dans le caddie.
Il a pris la leçon pour progresser en mathématiques.
J'ai ajouté le melon pour décorer la salade.
Il a mis les menottes pour pouvoir accompagner le prisonnier.
Mon oncle est le menuisier qui a fait ce fauteuil.
Mon frère dit que le peloton se trouve maintenant dans les montagnes.
La fille va souvent sur la pelouse pour regarder des fleurs.
Elle enlève la pelure avant de cuire la pomme.
Il m'a prêté la remorque pour emmener les meubles.
La plupart des gens considèrent le renard comme le concurrent du chasseur.
La tradition veut que le repas soit accompagné de vin.
Il faut mesurer le repli avant de raccourcir le pantalon.
J'ai appris que le requin vit dans l'océan.
Elle a acheté la revue pour s'informer sur la mode.
J'ai lu que la secouriste a pu atteindre la victime.
On m'a dit que la semelle tient bien sur la neige.
Il est important de vérifier la seringue avant de faire l'injection.
Marc dit que le squelette a été découvert dans la tombe.
Il a acheté la tenue pour s'identifier aux joueurs de football.
Elle a pris la tenaille pour enlever le clou.
Il a vu le chevreau naître dans la ferme.
J'ai appris que la crevasse est connue pour sa profondeur.
On a mis la semence qu'il nous avait donnée en terre.
Louis a envoyé le reporter sur le terrain pour faire une enquête.
L'enfant n'aime pas le fenouil mélangé aux pommes de terre.
Nous savons que la recluse préfère vivre dans le noir.
Il n'aime pas les petits pois qui se vendent en boîte de conserve.
Sophie trouve que le revers doit toujours etre garni d'une broche.
Ma mère m'a raconté que le chevalier habite dans un château.
J'ai appris que le chemisier est destiné à sa femme.
Je crois que le devin a besoin de la boule de cristal.
Il fait les devoirs qu'on lui donne pour réussir à l'école.
J'ai nettoyé le grenier avant d'aller au marché aux puces.
Je prends toujours le menu qui consiste en trois plats.

J'adore quand la meringue sort du four.
On dit que le monsieur en bleu se sent à l'aise parmi les femmes.
On m'a donné la recette pour faire des macarons.
On a vu que le rebelle a paralysé son ennemi.

Appendix B. Growth Curve Analysis: Competitor *vs.* neutral

We analyzed the differences between proportions fixations on the competitor picture and the average of the fixations ton the two neutral distractors. The four difference traces are shown in Figure B1. Note the values on the vertical axis, which range from -0.02 to + 0.03; in other words, in terms of proportions fixations the difference between competitor and neutral is very small. At first view, these traces are difficult to interpret. The fairly steep rise in the difference between target and competitor in Figure 3 in the main text that was accounted for by `poly1` in Table 1 in the main text is completely absent in Figure B1. Here, the traces for L1-full, L2-full and L1-reduced are best approximated by a parabola. For L1-reduced and L2-full the top of the parabola is located at approximately 450 ms after target word onset; for L1-full the top is substantially at approximately 700 ms after target word onset. The curve for L2-reduced is best approximated by a cubic function.

In an alternative interpretation of the curves it can be maintained that L1-full and L1-reduced are fairly similar, despite the time shift. However, there is a substantial difference between L2-full and L2-reduced, especially around 450 ms after target word onset. In the full stimuli the difference between the proportion fixations of the competitor and the neutral pictures is largest, while the reduced stimuli yield more fixations on the neutral picture than on the competitor. This observation is difficult to reconcile with the assumption that the pictures serve as a help in phonetic decoding and lexical access that might facilitate the processing of the reduced stimuli.

It appeared that the same model as used for the difference between the target and competitor picture yielded the largest negative AIC value. The model is shown in Table B1. In terms of significance of predictors Table B1 is very much a mirror image of the results of the analysis of the differences in proportions fixations on target and competitor pictures in Table 1 in the main text: most predictors remain significant in both analyses, but with opposite sign of the estimates and *t*-values. The most important difference between the two analyses is in the factor `group`, which is highly significant in the model of the difference between target and competitor, but not significant in the model for the difference between competitor and neutral. However, we now see a highly significant effect for the three-way interaction `poly3*group*reduced`, which suggests that it is not so much the difference between the two groups that matters, but rather the points in time when the relation between the three picture categories change, depending on the group membership of the listeners and the reduction status of the stimuli. Another difference is the that `poly1` and `poly2` have changed roles.

Our attempts to interpret the results of Growth Curve Analyses in terms of cognitive processes bring to light an important limitation of the technique. A significant effect of a polynomial of order > 1 or interaction between such a polynomial and a factor of interest does not tell at which point in time that effect occurs. To some extent this can be remedied by a visual interpretation of the curves (as we have done here). However, in the case of Figure 3 and Table 1 in the main text, where the effect size of first order polynomial is overwhelming, even the combination of statistical analysis

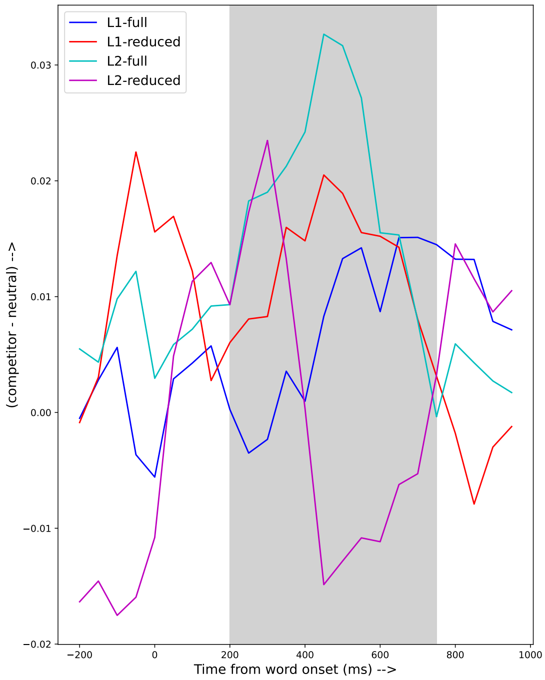

Figure B1.: Differences in proportions fixations between competitor and neutral pictures.

of the numerical data and the visual analysis of the curves defies an unambiguous interpretation of the data, let alone of the underlying processes.

Table B1.: Fixed Effects from the Growth Curve Analysis. The Dutch learners are on the intercept, so 'native' refers to the French natives. Full stimuli are on the intercept, so 'reduced' refers to the reduced stimuli.

	Estimate	t value	Pr(> $\|t\|$)	
(Intercept)	1.544e-02	2.128	0.037343	*
poly1	9.741e-03	0.539	0.591520	
poly2	-3.250e-02	-2.326	0.022104	*
poly3	-1.566e-02	-1.299	0.196329	
reduced	-1.394e-02	-4.016	6.22e-05	***
native	-9.477e-03	-0.932	0.355157	
poly1:reduced	-3.011e-02	-2.168	0.030278	*
poly2:reduced	2.282e-02	1.644	0.100458	
poly3:reduced	5.165e-02	3.720	0.000207	***
poly1:native	1.240e-02	0.489	0.625948	
poly2:native	3.732e-02	1.906	0.059633	.
poly3:native	1.319e-02	0.780	0.436627	
reduced:native	2.024e-02	4.159	3.37e-05	***
poly1:reduced:native	7.659e-03	0.394	0.693974	
poly2:reduced:native	-3.285e-02	-1.688	0.091645	.
poly3:reduced:native	-6.705e-02	-3.445	0.000586	***

Appendix C. Removing exogenous excitation

In the presence of sensory input signals, EEG signals represent the response of the brain to that input, combined with neural activity that is related to cognitive processes triggered by the sensory input. In the absence of any cognitive processing, the EEG signals would represent the passive response of the brain to the input. Figure C1 shows the excitation - the red amplitude envelope of the speech signal in blue at the top-left. The blue trace in the bottom-left picture shows the EEG signal from the Cz channel recorded when an arbitrarily selected learner listened to the sentence *Mon oncle est le menuisier qui a fait ce fauteuil.* The red trace in that picture shows the prediction of the response to the stimulus, under the -obviously untrue assumption- that the brain acted as a passive linear system. To a large extent the difference between the blue and red signals can be attributed to the effect of the endogenous activity, which is precisely what we are interested in in our experiment.

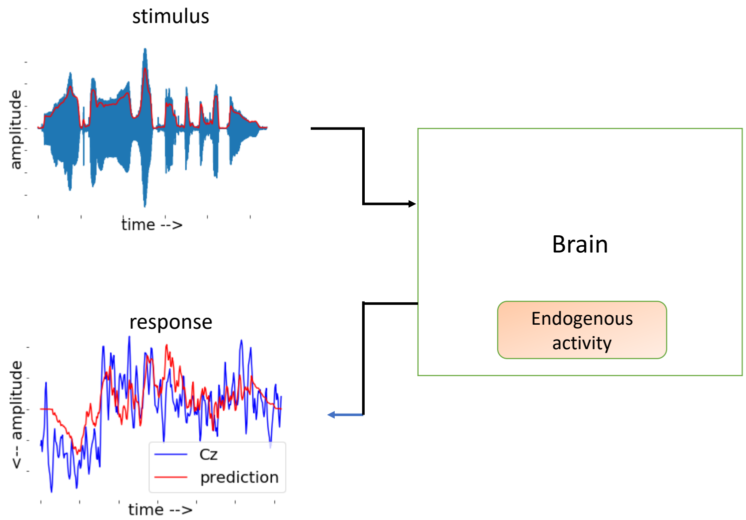

Figure C1.: Schematic representation of the operation of the brain when a participant listens to a spoken sentence. Top-left: the oscillogram of the sentence in blue and the Hilbert envelope in red. Bottom-left: the Cz signal recorded when a learner listened to the sentence in blue; the red signal is the prediction of the response to the exogenous stimulus if the brain would act as a passive linear system. The endogenous activity in the brain is responsible for most of the differences between the actual response and the prediction.

We follow Crosse, Di Liberto, Bednar, and Lalor (2016) in that we represent the auditory stimulus by means of the Hilbert envelope of the speech signal. Alternatively, we could have chosen the instantaneous loudness function computed with the Zwicker method (Zwicker & Fastl, 1990) or the Moore-Glasberg method (Moore, 2014). However, experiments showed that the results when using one of these computationally expensive methods did not differ much from what is obtained by using the computationally simple Hilbert envelope.

With $s(t)$ the stimulus function and $w(t)$ the impulse response of the brain as a passive linear filter, the EEG response $r(t)$ at some sensor is

$$r(t) = \int_0^T s(\tau).w(t-\tau)d\tau + \epsilon(t), \tag{C1}$$

where $\epsilon(t)$ represents the part of the output $r(t)$ that is present because the actual brain system is not a passive linear filter. The terms $s(\tau)$ and $r(t)$ in (C1) are known (observed; $r(t)$ is the observed EEG signal), but the term $w(t)$, the impulse response of the brain system, must be estimated. This can be done by minimizing the unexplained component $\epsilon(t)$ in

$$min(\epsilon(t) = \int_0^T (r(t) - \hat{r}(t))^2 dt, \tag{C2}$$

where $\hat{r}(t)$ is the best possible estimate of $r(t)$. This yields the optimal estimate of the impulse response $w_{optimal}(t)$. The algorithm for optimizing the optimal estimate of $\hat{w}(t)$ is based on De Boer and Kuyper (1968). Once $w_{optimal}(t)$ is known, the output that would be obtained in the brain acted as a passive linear filter can be computed (the red trace in the bottom-left frame of Figure C1) can be computed. The EEG response due to endogenous activity of the brain can then be approximated as the difference between the observed EEG and the predicted EEG signals.

C.1. Applying mTRF correction to eye movements

While the speech signals that the participants heard and the visual displays that they saw were always identical for each of the stimuli, the eye movements during the trials were trial-specific. We asked whether there might be residual effects on the EEG signals after removing the extensive cleaning that we performed, and if such residual effects might affect the statistical analyses of the EEG signals. Although the speech signals surely form exogenous excitation, electrophysiological effects of eye movements cannot be considered as exogenous. Moreover, it is not evident how eye movements can be represented in a similar manner as the speech signals.

We decided to use the velocity of the eye movements as a proxy for potential electrophysiological effects on the EEG signals. By using velocity we do away with the direction of the movements. This is motivated by the fact that potential effects of neural signals and muscular activity are most probably independent of the direction of the resulting eye movements. From Figure C2 it can be seen that this results in a pulse-like pattern. Opting for acceleration instead of velocity would only have strengthened the pulse-like character. We used mTRF to estimate the impact of the eye movements on the previously cleaned EEG signals, and performed an additional cleaning by subtracting these estimates from the EEG signals. We then subjected the resulting signals to the exact same statistical analyses as used with the signals that were only corrected for the exogenous excitation caused by the speech signals. We found that none of the `lme4` models differed in an interesting way from the results reported in the main text.

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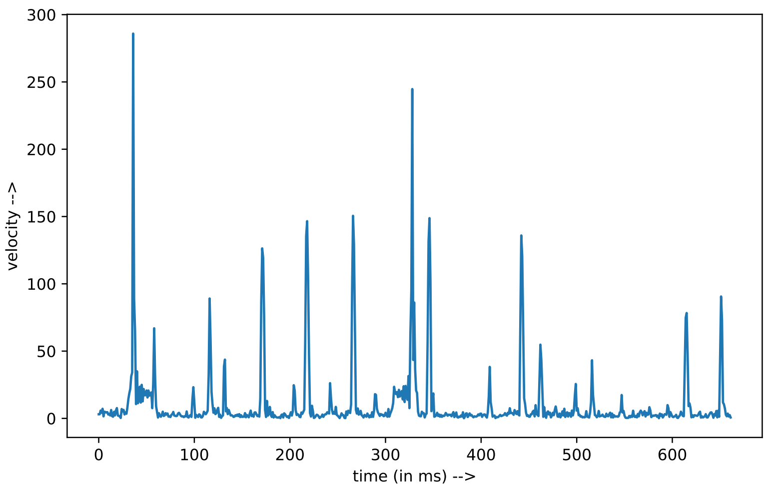

Figure C2.: The velocity of the eye movement in an arbitrary trial.

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