Does the speaker matter? Online processing of semantic and pragmatic

information in L2 speech comprehension.

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Abstract

The present study investigated how pragmatic information is integrated during L2 sentence comprehension. We put forward that the differences often observed between L1 and L2 sentence processing may reflect differences on how various types of information are used to process a sentence, and not necessarily differences between native and non-native linguistic systems. Based on the idea that when a cue is missing or distorted, one relies more on other cues available, we hypothesised that late bilinguals favour the cues that they master during sentence processing. To verify this hypothesis we investigated whether late bilinguals take the speaker's identity (inferred by the voice) into account when incrementally processing speech and whether this affects their online interpretation of the sentence. To do so, we adapted Van Berkum et al.'s (2008) study in which sentences with either semantic violations or pragmatic inconsistencies were presented. While both the native and the non-native groups showed a similar response to semantic violations (N400), their response to speakers' inconsistencies slightly diverged; late bilinguals showed a positivity much earlier than native speakers (LPP). These results suggest that, like native speakers, late bilinguals process semantic and pragmatic information incrementally; however, what seems to differ between L1 and L2 processing is the time-course of the different processes. We propose that this difference may originate from late bilinguals' sensitivity to pragmatic information and/or their ability to efficiently make use of the information provided by the sentence context to generate expectations in relation to pragmatic information during L2 sentence comprehension. In other words, late bilinguals may rely more on speaker identity than native speakers when they face semantic integration difficulties.

Keywords

It is reasonable to think that the mechanisms underlying first (L1) and second language (L2) systems are similar (e.g., Foucart & Frenck-Mestre, 2012; Kaan, 2014; Morgan-Short, Steinhauer, Sanz, & Ullman, 2012). However, native and non-native sentence processing have been shown to differ; indeed, event-related brain potential (ERP) studies have often revealed differences in terms of timing (e.g., delayed N400 in L2, a component reflecting semantic integration difficulty; Kutas & Hillyard, 1980) and patterns of effects (e.g., absent or reduced left anterior negativity (LAN) and/or P600 in L2, components reflecting syntactic integration and re-evaluation; Osterhout & Holcomb, 1992) (for reviews, see, Kotz, 2009; Moreno, Rodriguez-Fornells, & Laine, 2008). Here, we ask whether these differences reflect differences between L1 and L2 processing or rather differences as regards the use of different types of information.

L2 processing obviously puts the comprehender in a linguistic situation more complex than L1 processing. Hence, any cues (e.g., linguistic, visual) that can render such processing easier is likely to be used. If one of these cues is not available or is distorted, processing becomes more difficult (Hattori, 1987). That is why, for example, it is harder to understand an L2 on the phone than in face to face interactions, since visual cues (e.g., lip movements, facial expression, etc) are missing (Hardison, 1999). Note that relying on one or more cues when another is missing is not restricted to L2 processing (or to language, for that matter); the same happens in L1 processing, for example when the speech signal is distorted, native speakers rely more on visual cues (Sumby & Pollack, 1954). In the L2 literature, the idea of giving more weight to some cues than to others is not new; it has been suggested that late bilinguals may rely on semantic and pragmatic cues (declarative information) to compensate for their difficulty to process complex syntactic structures (Clahsen & Felser, 2006a, 2006b; Papadopoulou & Clahsen, 2003; Ullman, 2005). Although this proposal is not universally accepted (e.g., Hopp, 2010), it is a possibility that during sentence processing late bilinguals favour cues they master well. For example, as further

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detailed below, it has been suggested that late bilinguals may be more sensitive to pragmatic information than native speakers (Roberts & Felser, 2011), which may be reflected by different processing time or patterns.

In this study, we explored how pragmatic information is integrated during L2 sentence comprehension. Native speakers incrementally process semantic and pragmatic information to build up the linguistic meaning and interpret the message conveyed by a sentence (Hagoort, Hald, Bastiaansen, & Petersson, 2004; Van Berkum, Holleman, Nieuwland, Otten, & Murre, 2009). For example, information about the identity of a speaker (age, gender, etc.) is encoded incrementally along with other pragmatic, semantic and syntactic information. It is important to stress that non-native speakers with enough proficiency eventually process the linguistic information contained in a sentence, otherwise off-line comprehension should be poorer in L2 than in L1, which is not the case (Felser & Roberts, 2007; Marinis, Roberts, Felser, & Clahsen, 2005). The question is whether they do so in a similar manner as native speakers. Different timing of processing, for instance, would explain why late bilinguals do not anticipate upcoming words to the same extent as native speakers (Dussias, Valdés Kroff, Guzzardo Tamargo, & Gerfen, 2013; Gruter, Lew-Williams, & Fernald, 2012; Hopp, 2013; Lew-williams & Fernald, 2011; Martin et al., 2013; but see Foucart, Martin, Moreno, & Costa, 2014), since anticipation implies rapid use of the information provided by the sentence context to predict upcoming words (see Kaan, 2014 for a review on predictive processing in L2). Here, we investigate how late bilinguals process semantic and pragmatic information during speech processing.

Semantic processing has received great interest in the L2 literature. ERPs have proven useful in comparing native and non-native processing by looking at the modulation of the N400 component during sentence processing. The magnitude of the N400 is known to increase for semantically incorrect words as compared to correct ones as in "I take my coffee with cream and *dog*" (Kutas & Federmeier, 2011; Kutas & Hillyard, 1980).

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Overall, the N400 is of similar amplitude in early and late bilinguals, however sometimes it is delayed in less proficient bilinguals (Hahne, 2001; Weber-Fox & Neville, 1996). Hence, the difference (sometimes) concerns the time-course.

Regarding pragmatics, a few studies have looked at the effect of plausibility on the resolution of ambiguous sentences. Overall, like native speakers, non-native speakers appear to incrementally use plausibility to interpret sentences, but importantly, they seem to rely more on it than native speakers. For example, Roberts and Felser (2011) found a greater influence of plausibility on real-time processing of garden path sentences in the L2. In a self-paced reading study, they presented participants with sentences such as "The journalist wrote the book (the girl) had amazed all the judges". In this kind of sentences, readers tend to initially analyse the ambiguous noun phrase (the book/the girl) as direct object of the verb (wrote), resulting in longer reading times for an implausible direct object (wrote the girl) than for a plausible one (wrote the book). Native readers rapidly recover from an initial misanalysis. The results revealed, however, that recovery was more costly for L2 learners. The authors attributed this greater cost to non-native speakers' high sensitivity to plausibility information (see also Williams, Möbius, & Kim, 2001; Williams, 2006). These results are consistent with the fact that non-native speakers appear to be more sensitive to discourse-pragmatic information than native speakers during pronoun processing (Felser, Sato, & Bertenshaw, 2009; Roberts, Gullberg, & Indefrey, 2008). Indeed, when the sentence is syntactically ambiguous (e.g., there are two potential antecedent pronouns available from the discourse context), non-native speakers tend to rely more on pragmatics to resolve the ambiguity.

In sum, whilst non-native speakers incrementally process linguistic information in their L2 (for reviews see, Frenck-Mestre, 2002 and Roberts, 2013), they are more sensitive to pragmatic information and a processing delay is sometimes observed. As further

described below, studies have shown that native speakers process semantic and pragmatic simultaneously (Hagoort et al., 2004; Van Berkum et al., 2009, 2008; van den Brink et al., 2012; but see Lattner & Friederici, 2003), however, it remains unknown whether non-native speakers can do so, and whether they integrate pragmatic online. Here, we used ERPs to characterise semantic and pragmatic (indexical properties) online integration in late bilinguals who were required to take into account the speaker's identity during speech comprehension.

In L1, ERP studies investigating processes elicited by semantic violations and pragmatic inconsistencies have provided contrasting views (Hagoort et al., 2004; Lattner & Friederici, 2003; Van Berkum et al., 2009, 2008; van den Brink et al., 2012). For instance, in response to pragmatic inconsistencies with the speaker's properties, Van Berkum et al. (2008) observed an N400 effect. In line with previous studies showing an N400 in response to other types of pragmatic inconsistencies (e.g., world knowledge), the authors concluded that lexico-semantic and pragmatic information is rapidly and simultaneously integrated during sentence comprehension (Hagoort et al., 2004; Nieuwland, Ditman, & Kuperberg, 2010; Politzer-Ahles, Fiorentino, Jiang, & Zhou, 2013; Tesink et al., 2009; Van Berkum et al., 2009; van den Brink et al., 2012). Conversely, Lattner and Friederici (2003) found a late positive potential (LPP) in response to utterances that did not match the speaker's gender. They concluded that semantic processing is not affected by the speaker's voice, and that the speaker's properties are integrated at a later stage during sentence processing. These results are in line with studies examining the integration of social knowledge in sentence comprehension (Osterhout, Bersick, & McLaughlin, 1997). The LPP in particular has been considered to reflect the ''re-integration of semantic meaning and stereotypical beliefs" (Lattner & Friederici, 2003; Osterhout et al., 1997). Studies have also reported overlapping N400 and LPP effects, in which the N400 is suggested to indicate an inconsistency with an expectation (e.g., social expectancy) and the LPP a re-evaluation

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of the inconsistency, requiring additional processing resources (Baetens, der Cruyssen, Achtziger, Vandekerckhove, & Van Overwalle, 2011; Van Berkum et al., 2009).

Taken together, previous results do not allow deciding whether speaker identity influences the interpretation of the linguistic message at early (N400) or later (LPP) stages of sentence processing. Indeed, the N400 is considered an indicator of early sense making, and its amplitude is larger when a word is semantically inconsistent with or unexpected from the sentence context (DeLong, Urbach, & Kutas, 2005; Kutas & Hillyard, 1980). In contrast, the LPP is assumed to indicate re-analysis (Osterhout et al., 1997). The presence of one component or the other could help tearing apart two contrasting models of sentence comprehension. One model suggests that comprehenders first process semantic information and only later interpret the meaning in relation to pragmatic information (Lattner & Friederici, 2003), whereas the other model claims that pragmatic information is processed as early as semantic information (Van Berkum et al., 2008). Hence, the contrasting results from Van Berkum et al. (2008) and Lattner and Friederici's (2003) studies do not allow drawing clear-cut conclusion about whether meaning and speaker's identity are both processed early, or whether meaning is processed first and later re-interpreted in relation to the speaker.

The present study

We adapted Van Berkum and colleagues' (2008) experiment to investigate whether speaker identity influences L2 speech processing. The original study involved 160 sentences containing pragmatic inconsistencies such as the speaker's gender ("If only I looked like Britney Spears in her latest video", spoken in a male voice), age ("Every evening I drink some wine before I go to sleep", spoken in a young child's voice) or social-economic status ("I have a large tattoo on my back", spoken in an upper-class accent). Participants processed each sentence for comprehension with no additional task. Ninety-six sentences containing semantic violations were also included. The total

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sentences were recorded by 21 different speakers. The results revealed an N400 (200-700 ms) for both semantic violations and pragmatic inconsistencies. A post-hoc analysis also showed an additional LPP for inconsistencies initiated by gender (male/female), which was not observed for other types of voice inconsistencies (age and social-economic status).

Adapting their design, we compared a group of late advanced learners of Spanish to a control group of Spanish native speakers who listened to sentences produced by a consistent or an inconsistent speaker (see Table 2 for example). We also included a set of sentences containing semantic violations for comparison. We were particularly interested in the comparison of the ERPs elicited by the interaction of semantic and pragmatic inconsistencies in L1 and L2. In response to semantic violations, we expected an N400 component of same amplitude for both the native and non-native groups (Hahne, 2001; Kutas & Hillyard, 1980), potentially delayed in the latter, as often (but not always) observed for semantic violations (Hahne, 2001; Weber-Fox & Neville, 1996). A delay would suggest that semantic information is processed slightly later in L2. Regarding pragmatic inconsistencies we expected native speakers to display an N400 modulation or an LPP modulation or both (Lattner & Friederici, 2003; Van Berkum et al., 2008). An N400 would suggest that semantic and pragmatic information is integrated simultaneously at an early stage of sentence comprehension. Conversely, the presence of an LPP would suggest that meaning is processed first and re-interpreted later in relation to pragmatic information. Late bilinguals would display similar effects, unless they are more sensitive to pragmatic information than native speakers in which case, we may observe differences between the L1 and the L2 group in relation to speaker identity mismatches. We expected such differences to appear in terms of timing and/or pattern of effects.

Method

Participants

We conducted the experiment in a control group of 28 native speakers of Spanish[1] and a group of 29 late bilinguals (19 L1-English, 9 L1-German and 1 L1-Swedish). Participants' details are provided in Table 1. They all had normal or corrected-to-normal vision and reported having no auditory disability. They were paid for their participation and gave written informed consent. The groups were matched in terms of gender and age. Late bilinguals had started learning Spanish around the age of 13 years. Both groups self-rated their proficiency in Spanish for oral/written comprehension and oral/written production on a 7-point scale (1 = "low proficiency" and 7 = "high proficiency"). All participants completed a Spanish Vocabulary and their empathy quotient was measured using the Spanish translation of the Empathizing and Systemizing Questionnaire (Baron-Cohen & Wheelwright, 2004). This measure was collected because a recent study showed that people who emphasize to a larger extent are more sensitive to socially-based information (van den Brink et al., 2012, see Discussion).

Table 1. Participants' details

	Native Spanish speakers (N=28)	Non-native speakers (N=29)
Number of females	13	15
Mean age	22 yrs (SD=0.5; range = 18-28)	26 yrs (SD=0.5; range = 20-32)
Mean age of L2 acquisition		13 yrs (SD=7.11)
Months Immersed in the foreign language country		2.8 mths

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Self-rated proficiency in the L2 *(1=least fluent, 7=most fluent)*		
Written comprehension	7	5.2
Written production	6.8	4.5
Oral production	6	4.8
Oral comprehension	7	5.3
Vocabulary test (out of 100)	94 (SD=3.0)	83 (SD=8.0)
Empathy score (scale 0-80)	42.2 (SD=8.7)	45.1 (SD=11.1)

2. 2. Materials

Three-hundred and sixty experimental sentences were created in Spanish and divided into 120 triplets. Each triplet was composed of three versions of the same sentence corresponding to the following conditions: Consistent Speaker (CS) in which the content of the message matched the speaker's identity; Semantic Violation (SV) in which the critical word was replaced by a word that did not match the preceding semantic context; and Inconsistent Speaker (IS) in which the sentence was similar to the CS condition but produced by an inconsistent speaker (mismatch with the speaker's age or gender, see Table 2 for examples, and Appendix for a complete list of the materials). In contrast to Van Berkum et al. (2008), we did not include the social-economic condition because it involves factors that may vary for native and non-native speakers (which is not the case for gender and age). Three lists were created so that each participant would listen to only one of the version of each triplet. Each list contained 40 CS sentences, 40 SV sentences and 40 IS sentences. In addition, 40 filler sentences were included to balance the number of consistent (80 sentences) and inconsistent sentences (80 sentences). In total, each participant listened to 160 sentences. All sentences were correct up to the critical word. The critical word was

preceded by a minimum of three words so that participants could extract indexical information from the voice, and was never presented sentence final. Critical words were matched for age of acquisition (*p*=0.43), frequency (*p*=0.97), imageability (*p*=0.62) and concreteness (*p*=0.44) (values are reported in Table 3) using B-Pal (Davis & Perea, 2005). To reduce any effect of lexical anticipation (Federmeier, 2007; Kutas & Hillyard, 1984) cloze probability[2] was checked for in pre-test involving 40 participants who did not take part in the experiment. The pre-test was also designed to check for voice acceptability; participants assessed whether the voice (man/woman, boy/girl) matched sentence content (plausibility) using a 5-point scale (1="completely normal"; 5="very strange"). The scores (reported in Table 3) obtained are similar to those reported in Van Berkum et al. (2008).

Recordings. Speakers were nine adults aged 23 to 45 years old (women = 4) and eight children aged 7 to 10 (girls = 4). To avoid participants associating a voice to a specific condition each speaker recorded the sentences in all three conditions. Recordings were edited using the audio program Audacity (Version 2.0.2 htpp://audacity.sourceforge.net). The speech ratio and the duration of the critical word of all speakers were matched across conditions (see Table 3 for details).

Table 2. Examples experimental sentences. Critical words are in italics, English translation in brackets.

Consistent speaker/Inconsistent speaker	Semantic violation	Type of inconsistency
"Hablo mucho con mi *hijo* los fines de semana"	"Hablo mucho con mi *valle* los fines de semana"	
[I talk a lot to my *son at* the weekend]	[I talk a lot with my *valley at* the weekend]	
<u>Speaker</u>: woman/girl.	<u>Speaker</u>: woman.	

		Age
"Me encuentro mal hoy, tendré que ir a mi *pediatra* otra vez"	"Me encuentro mal hoy, tendré que ir a mi *oeste* otra vez"	
[Today I'm feeling sick, I'll need to visit my *pediatrician* again]	[Today I'm feeling sick, I'll need to visit my *west* again]	
<u>Speaker</u>: girl/woman.	<u>Speaker</u>: girl.	

		Gender
"Odio cuando los hombres se fijan en mi *escote* más que en mis ojos"	"Odio cuando los hombres se fijan en mis *células* más que en mis ojos"	
[I hate it when men stare more at my *cleavage* than at my eyes]	[I hate it when men stare more at my *cells* than at my eyes]	
<u>Speaker</u>: woman/man.	<u>Speaker</u>: woman.	
"Tengo problemas de *erección* a causa del estrés"	"Tengo problemas de *contador* a causa del estrés"	
[I have *erection* problems due to stress]	[I have *meter* problems due to stress]	
<u>Speaker</u>: man/woman.	<u>Speaker</u>: man.	

Table 3. Properties of the sentences and critical words across conditions.

	Consistent speaker		Semantic violation		Inconsistent speaker	
	Mean	SEM	Mean	SEM	Mean	SEM
Sentence properties						
Speech ratio (words/sec)	3.5	0.1	3.6	0.1	3.4	0.1
Number of words	11.6	0.02	11.6	0.02	11.6	0.02
Cloze Probability (%)	7.6	1.1	0.0	0.0	7.6	1.1
Plausibility (1 = normal; 5 =	1.2	0.0	4.6	0.10	3.9	0.1

weird)

Critical Word properties

Word duration (ms)	512	16.10	479	15.8	539	15.1
Word Position	6.7	0.02	6.8	0.02	6.8	0.02
Age of Acquisition in months (range 100-700)	173	96	253	49	173	96
Word Frequency (log)	2.9	0.1	2.7	0.1	2.9	0.1
Imageability	359	34	336	32.2	359	34
Concreteness	346	34.3	310	32.2	346	34.3

Procedure

After filling in the language background questionnaire and completing the vocabulary task, participants received oral and written instructions. The experiment consisted of two tasks: the Listening task and the Rating task described below. Each participant was assigned one of the three lists. Stimuli were presented and participants' responses recorded using e-Prime 2.0 (Schneider, Eschman, & Zuccolotto, 2002).

Listening Task. Eight blocks of 20 trials were presented with a break in-between. Prior to the experiment, 6 sentences (not used in the task) served as practice. A fixation cross appeared on the screen 1000 ms before sentence onset and stayed for 1000 ms after the offset. All sentences were presented through loudspeakers. The screen remained blank for 3600 ms between each trial. Participants were instructed to blink when the fixation cross was not present. A "yes/no" comprehension question was visually presented in 25% of the trials right after the auditory sentence to ensure participants were paying attention (91% and 86% of correct answers for the native and the non-native groups, respectively).

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<u>Rating Task</u>. Participants had to rate each experimental sentence heard during the Listening task on a 1-to-4 scale as follows, 1="Normal taking into account who said it", 2="Weird taking into account who said it", 3="It doesn't make sense" and 4="I don't understand". All trials followed the same presentation design as in the Listening task, except that they were presented in a single block. The Rating task was completed after the Listening task and not after each sentence to avoid participants' attention to be directed on the evaluation of sentences.

EEG recording and pre-processing

Electrophysiological data was recorded from 32 cap-mounted electrodes placed according to the 10-20 convention (Jasper, 1958) referred to the left mastoid electrode. External electrodes were placed next to and below the right eye (converted off-line to bipolar horizontal and vertical EOG signals respectively) and on the right mastoid. Impedances were kept below 5kΩ. Signals were recorded using a BrainAmps DC amplifier with a 200Hz low-pass filter and a 1000Hz sampling frequency. Sampling rate was then changed to 500Hz during pre-processing (Brain Vision Analyzer 2.0; Brain Products GmbH, Munich, Germany) and data was re-referenced to the two mastoid electrodes. Data was filtered off-line with 80Hz (48dB/oct) low-pass filter, 0.03Hz (48dB/oct) high-pass filter and notch filter at 50Hz. Baseline correction was performed in reference to pre-stimulus activity (-200; 0 ms) and afterwards semi-automatic artifact rejection was run (differences in values 75 µv in 100 ms intervals, and amplitudes of +/- 100 µv), resulting in 11.8%, 11.7% and 11.9% of rejection for the CS, SV and IP conditions for the native speaker group, and 12.6%, 12.8% and 12.2% for the late bilingual group. Four participants were excluded from the analyses in each group due to technical problems or to a high number of rejected epochs, resulting in 24 and 25 participants in the native and non-native group, respectively.

Data analysis

Behavioural data (Rating task).

An ANOVA with Group as a between-subject factor (native vs. non-native groups) and Condition as a within subject factor (CS, SV, IS) was conducted on the percentage of expected answers for each condition (i.e., the number of time participants responded "1=Normal taking into account who said it" for CS, "2=Weird taking into account who said it" for IS, and "3=It doesn't make sense" for SV).

ERP data (Listening task)

ERP data was analyzed on mean voltage amplitudes from the onset of the critical word. ANOVAs were performed with Group (native vs. non-native groups) as a between participant factor and repeated measures for Condition (CS, SV, IS) and Region (Frontal, Central and Parietal) as within participant factors. The factor Region was composed of three scalp regions: Frontal (F7, F3, FC5, FC1, Fz, F8, F4, FC6, FC2), Central (T3, C3, CP5, CP1, Cz, T4, C4, CP6, CP2) and Parietal regions (T5, P3 P1, O1, Pz, O2, P2, T6, P4)[3]. Following the results reported in previous studies, the main components of interests were the N400 (400-700 ms; Van Berkum et al., 2008) and the LPP (700-1200 ms; similar as the 600-1000 ms time-window used in Lattner & Friederici, 2003). To verify the presence of earlier effects, we also conducted analyses in the 100-400 ms time-window; in this early time-window, the factor Condition did not reach significance nor did it interact with other factors[4]. When an interaction reached significance post-hoc analyses were conducted (Bonferroni test). The Greenhouse-Geisser correction (Greenhouse & Geisser, 1959) was applied to all repeated measures with greater than one degree of freedom; in this case, the corrected *p* value is reported.

Results

Behavioural data (Rating task).

The percentages of behavioural answers for each condition are reported in Table 4. The ANOVA on the percentage of expected answer for each condition showed a significant effect of Condition ($F(2,94)=33.593$, $p<.001$, $\eta^2 = .42$) and a significant interaction of Condition x Group ($F(2, 94)=21.019$, $p<.001$, $\eta^2 = .31$). Post-hoc analyses revealed that responses for the native and the non-native groups differ for all the conditions (CS, $p<.001$; SV, $p<.001$; IS, $p<.008$), this was mainly due to the fact that non-native speakers answered "I don't understand" overall significantly more often than the native group ($t(47) = 15.75$, $p<.001$). Looking at Table 4, the score for the inconsistent speaker condition in the non-native group can first appear as low. However, when looking at the scores for consistent and inconsistent speakers in both groups, there is a difference of 15% and 13% in the native and the non-native groups, respectively. Therefore, even though the score is lower in the non-native group, it seems that speaker inconsistency affected accuracy similarly in both groups.

Table 4. Behavioural answers in percentage for each condition (CS, SV and IS) and each option of the 1-to-4 scale (1="Normal taking into account who said it", 2="Weird taking into account who said it", 3="It doesn't make sense" and 4="I don't understand") for the two groups (L1 and L2). The data used for the analyses on the expected answer is in bold. Standard deviations are provided in parentheses.

Conditions	Groups	Answer 1	Answer 2	Answer 3	Answer 4
CS	L1	**91 (5)**	7 (4)	1 (1)	1 (1)

	L2	**78 (13)**	6 (5)	5 (4)	11 (9)
SV	L1	4 (8)	2 (2)	**90 (11)**	5 (5)
	L2	19 (13)	5 (4)	**54 (15)**	22 (9)
IS	L1	20 (11)	**76 (10)**	4 (4)	0 (1)
	L2	20 (10)	**65 (15)**	6 (4)	10 (8)

ERP data

All the effects and interactions are reported in Table 5 and grand means in Figure 1.

Time-window 400-700 ms

The main effects of Condition ($F(2, 92) = 18.36$, $p<.001$, $\eta^2 = .28$) and Region ($F(2, 92) = 3.34$, $p=.04$, $\eta^2 = .07$) were significant. The interactions Condition x Region ($F(4, 184) = 3.64$, $p<.001$, $\eta^2 = .07$) and Condition x Region x Group ($F(4, 184) = 5.67$, $p<.001$, $\eta^2 = .11$) also reached significance.

Post-hoc analyses revealed that SV was more negative than CS ($p<.001$) and IS ($p<.001$), but IS did not differ from the CS ($p= .32$). The interaction Condition x Region was due to a more negative deflection for SV compared to CS and IS over the whole scalp ($p<.001$, for the three regions), and to a more positive deflection for IS compared to CS at Central ($p=.037$) and Parietal regions ($p=.02$), and compared to SV at all sites ($p<.001$, for the three regions).

The interaction Condition x Region x Group - The CS vs. SV comparison revealed a negative deflection at centro-parietal sites in the native group (Frontal: $p=.47$; Central: $p<.001$; Parietal: $p<.001$), and at frontal and central sites in the non-native group (Frontal: $p<.001$; Central: $p=.04$; Parietal: $p<1$). Peak analyses showed that the

negativity was slight delayed in the non-native group compared to the native group (25 ms), but this difference was not significant (p=.35). The CS vs. IS comparison showed no difference in the native group (p<1 for all regions), and a larger positive deflection for IS than CS in the non-native group at centro-parietal sites (Frontal: p<1; Central: p<.001; Parietal: p=.02).

Time-window 700-1200 ms

The main effects of Condition ($F(2, 92) = 10.23$, p<.001, $\eta^2 = .18$) and Region ($F(2, 92) = 28.41$, p <.001, $\eta^2 = .38$) were significant. The interaction Condition x Region also reached significance ($F(4, 184) = 4.10$, p<.001, $\eta^2 = .08$). No interaction involving the factors Condition x Group reached significance.

Post-hoc analyses revealed significant differences between CS vs. SV (p=.03) and SV vs. IS (p <.001) but not between CS vs. IS (p=.18). The interaction Condition x Region showed that SV was more negative than CS at frontal (p <.001) and central sites (p<.001), that IS was more positive than CS at central (p <.001) and parietal sites (p <.001), and that SV was more negative than IS at all sites (p <.001).
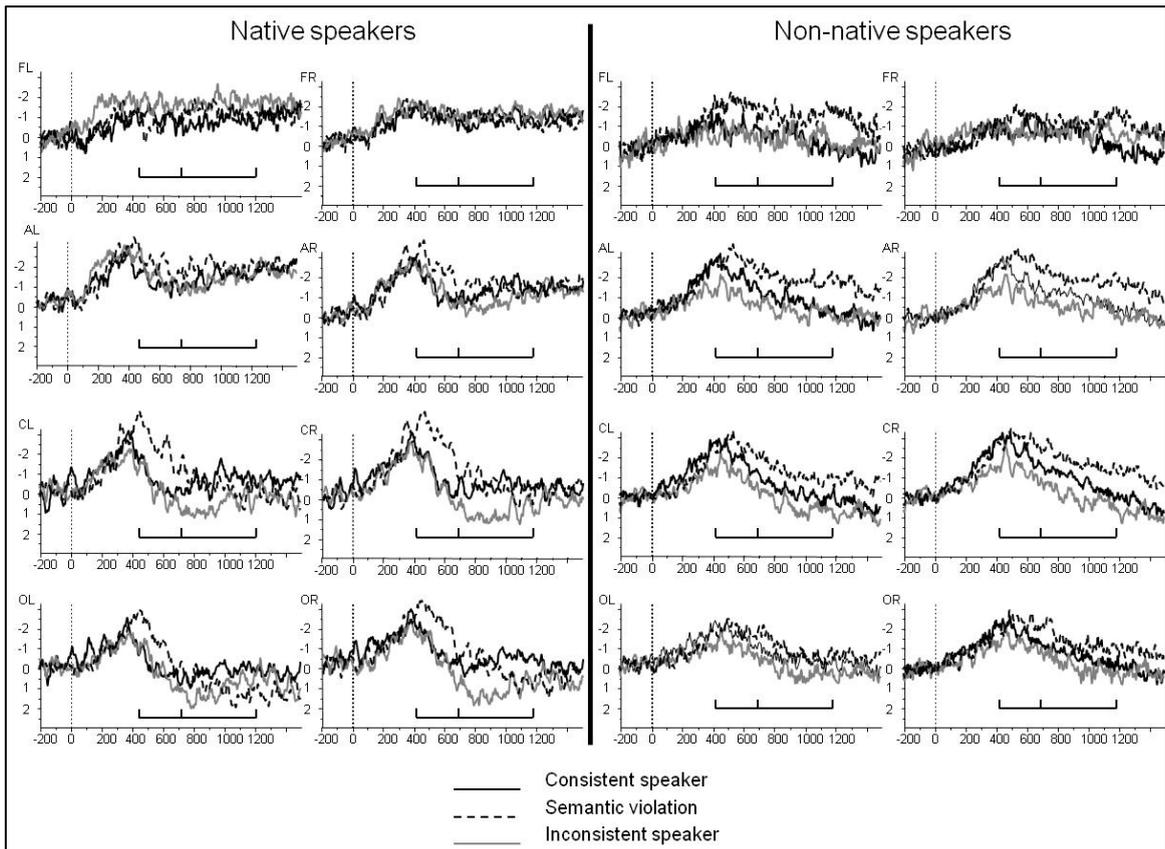
Figure 1. Grand means for the native group (left panel) and the non-native group (right panel) for the three condition (CS = black, SV = dotted, IS = grey) over the frontal left (FP1, F3, F7), Frontal Right (FP2, F4, F8), Anterior Left (C3, FC1, FC5), Anterior Right (C4, FC2, FC6), Centro-parietal Left (P3, CP1, CP5), Centro-parietal Right (P4, CP2, CP6), Occipital Left (T5, PO1, O1), Occipital Right (T6, PO2, O2) regions. Negativity is plotted up. The horizontal bars represent the 400-700 ms and the 700-1200 ms time-windows.

Table 5. Summary of the statistical results of the ERPs in the time windows 400-700 ms and 700-1200 ms time-windows. Reported values are rounded up. Abbreviations used for the effects and interactions: G= Group, C = Condition, R= Regions.

	df	Time-window 400-700 ms		Time-window 700-1200 ms	
		F	*p*	*F*	*p*
G	1, 46	2.20	.14	0.21	.64
C	2, 92	18.35	.001	10.23	.001
CxG	2, 92	1.53	.22	0.26	.77
R	2, 92	3.34	.04	28.41	.001
RxG	2, 92	2.26	.11	8.66	.001
CxR	4, 184	3.64	.001	4.10	.001
CxRxG	4, 184	5.67	.001	1.13	.34

To sum up, the results revealed a significant negativity for both groups in response to semantic violations (SV vs. CS), and a positivity in response to pragmatic violations (IS vs. CS), emerging earlier for the L2 than the L1 group.

Discussion

The present study investigated how pragmatic information is integrated during L2 sentence comprehension. We put forward that the differences often observed between L1 and L2 sentence processing may reflect differences on how various types of information are used to process a sentence, and not necessarily differences between native and non-native linguistic systems. Based on the general idea that when a cue is missing or distorted, one relies more on others (e.g., Sumby & Pollack, 1954; Clahsen & Felser, 2006b in the L2 literature), we hypothesised that late bilinguals, when processing a sentence in L2 (a more complex linguistic situation than in L1) may favour

cues they master well over others, which may be reflected by differences in timing and/or patterns of effects compared to L1 processing. To verify this hypothesis we investigated whether late bilinguals take the speaker's identity (inferred by the voice) into account when incrementally processing speech and whether it affects their online interpretation of the sentence. To do so, we adapted Van Berkum et al.'s (2008) study in which sentences with either semantic violations or pragmatic inconsistencies were presented. While both the native and the non-native groups showed similar response to semantic violations (N400, although more frontal for the non-native group[5]), their response to speakers' inconsistencies slightly diverged; late bilinguals showed a positivity much earlier than native speakers (LPP). Before discussing the implications of the results for L2 sentence comprehension, we contrast the results obtained for the native group with those obtained in previous L1 studies.

Pragmatic processing in L1 sentence comprehension

In native speakers, pragmatic inconsistencies provoked an LPP (in the 700-1200 ms time window) but no N400. At first sight, these results suggest that semantic processing is not affected by the speaker's voice, and that pragmatic inconsistencies are not treated a mismatch with socially-based expectations. Our results contrast with those obtained by Van Berkum et al. (2008) who observed an N400 effect in response to similar inconsistencies, but are in line with the LPP reported by Lattner and Friederici (2003). It is not clear why different components are found for pragmatic inconsistencies; several accounts are possible such as adaptation effects and individual differences, experimental design or potential overlap of the N400 and the LPP. We address each point below.

Adaptation effects and individual differences. Van den Brink and colleagues (2012) who used the same materials as Van Berkum et al. (2008) found an adaptation effect in response to speaker's inconsistency; that is, they observed an N400 effect in the first

half of the experiment and an LPP effect in the second half. They proposed that participants first treated inconsistencies as a mismatch with their stereotypically-based expectations, which triggered an N400 component as usually observed when a word does not fit within the preceding context (Federmeier, 2007; Kutas & Hillyard, 1980); they then gradually adapted to the expectation and proceeded to a simple re-evaluation of the inconsistency. Moreover, in the same study, they correlated the N400 component with participant's individual results to a test measuring cognitive empathy. This correlation revealed that people who empathise to a larger extent are more sensitive to socially-based information. The authors underlined the importance to take into consideration inter-individual differences when analysing data (Kosslyn et al., 2002). Here, the visual inspection of our data revealed that some participants (N=8) displayed an N400-like component in response to pragmatic inconsistencies but since it could not be correlated to any specific factor (e.g., sex or empathy score) no conclusion can be drawn (see footnote 6, and below for individual differences in relation to word anticipation).

Experimental design. Another possible explanation for the variability of results across studies is the experimental design. Studies that reported an N400 (Van Berkum et al., 2008; van den Brink et al., 2012) do not precise whether the cloze probability of the sentences was controlled for; this factor might have favoured the elicitation of the N400 effect. On the other hand, Lattner and Friederici's (2003) design did not include fillers nor any other conditions to distance the participant from the goal of the experiment; hence, participants may have stopped relying on the stereotypical information once they realised it was not consistent. Moreover, as previously mentioned, Van Berkum and colleagues (2008) observed an LPP in addition to the N400 when inconsistencies involved male/female speakers; it is unclear why, but it converges with the effect reported by Lattner and Friederici whose study involved gender inconsistencies only.

Potential overlap of the N400 and the LPP. The N400 and the LPP are two ERP

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components that have opposite voltages; hence, the possibility that both components may be present but not visible in the grand average cannot be ruled out. Recently, Baetens and colleagues (Baetens et al., 2011) observed both an N400 and an LPP in response to inconsistencies in trait inferences and concluded that the N400 reflects difficulty in processing an inconsistency with an expectation (e.g., social expectancy) and the LPP indicates re-evaluation of the inconsistency, rousing additional processing resources. Thus, in the present study there is a possibility that N400 modulations may have been masked by the LPP; and similarly, an earlier onset of the LPP (P300) may have been cancelled out by a negative modulation in the 400-700 ms time-window (for discussion on overlapping effects, see Franklin, Dien, Neely, Huber, & Waterson, 2007 and Roehm, Bornkessel-Schlesewsky, Rösler, & Schlesewsky, 2007). Actually, as mentioned earlier, individual data revealed different patterns of effect within the native group; while the majority displayed an LPP (N=10), other showed an N400-like component (N=8) while the rest (N=6) did not show any clear ERP differential (see footnote 6). This observation suggests some variety in the way native speakers approach pragmatic inconsistencies; that is, the absence of an early differential in native speakers does not seem to reflect a consistent overlap of components in every participant, but rather seems to be due to each participant showing either one component or the other. The possibility that individuals would trigger different processes when dealing with pragmatic information is consistent with Van Berkum's results showing variability in the effects observed (an N400 or LPP depending on the type of inconsistency and timing within the experiment).

In sum, although it is not clear why we did not observe an N400 in response to pragmatic inconsistencies, what is important for our purpose is first, that the native group' data coincide with previous L1 studies (Lattner & Friederici, 2003; Osterhout et al., 1997), and second, that it allows us to examine whether late bilinguals process semantic and pragmatic information in a similar manner as native speakers.

Pragmatic processing in L2 sentence comprehension

In response to pragmatic inconsistencies, late bilinguals showed a positive deflection already from the 400-700 ms time-window, which is earlier than the effect found in native speakers. Given its centro-parietal distribution, this effect could be associated to a P300, a component that is considered to reflect processing of inconsistent stimulus within the preceding context (Donchin, 1981). Hence, the presence of this positivity clearly indicates that non-native speakers process pragmatic information online in relation to the sentence context, showing that both semantic and pragmatic information are processed incrementally to interpret the sentence. The present results suggest that, like native speakers, late bilinguals are able to process various sources of information during sentence processing; however, what seems to differ between L1 and L2 processing is the time-course of the different processes.

One possible account for the difference of onset between the native and non-native groups may be that late bilinguals rely on pragmatic information from the beginning of word processing whereas native speakers first process semantic information and then pragmatic information. This account converges with that proposed by L2 studies examining plausibility effects and discourse-pragmatic information processing, in that they suggest that non-native speakers are more sensitive to discourse-pragmatic information than native speakers (Felser et al., 2009; Roberts & Felser, 2011; Roberts et al., 2008; Williams et al., 2001; Williams, 2006). As previously proposed, in complex linguistic situations, late bilinguals may have the tendency to rely more on some information to compensate their difficulty to process other type of information (Clahsen & Felser, 2006a, 2006b; Ullman, 2005). It is possible that when a statement does not match the listener's pragmatic expectation (e.g., that an adult would sleep with his teddy bear), it renders the sentence more complex; in this case, late bilinguals may tend to rely more on the information with which they are more confident. This is

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consistent with the proposal of easier incremental processing of linguistic information that is known well or that can be transferred from the L1 (Dussias et al., 2013; Foucart et al., 2014; Hopp, 2013). Indeed, pragmatic processing is common across the L1 and the L2 for its extra-linguistic aspect; lexico-semantic processing, on the other hand, depends on the listener's proficiency, and is often slower in L2 (Moreno et al., 2008; Roberts, 2013). The results of the behavioural task suggest that overall non-native speakers are less confident than native speakers when there is a lexico-semantic incongruence in the sentence (they tended to answer "I don't understand" more often than native speakers). Thus, when having to process different types of information, late bilinguals may rely more on pragmatic information. Though, as it happens with other types of processing (e.g., syntactic processing), this tendency is very likely to decrease as proficiency increases, and sentence processing to become more automatic and native-like (Hopp, 2010; Osterhout, Mclaughlin, Pitkänen, Frenck-mestre, & Molinaro, 2006; Ullman, 2005).

Another possible account for the difference between the time-course in L1 and L2 processing is related to expectation. As mentioned above, the LPP in native speakers is visible only from the later time-window because its earlier onset may have been masked by a negative modulation in the 400-700 ms time-window. Indeed, individual data revealed that a considerable number of native speakers (N=8) showed a negativity, suggesting that, in some individuals, pragmatic inconsistencies provoke an N400 reflecting the difficulty to integrate a word that is (pragmatically) unexpected from the preceding context, in line with previous studies (Hagoort et al., 2004; Van Berkum et al., 2008; van den Brink et al., 2012). In contrast, screening of the L2 group's individual data revealed that the majority of the participants showed an LPP (N=14), whereas only one showed a negativity and the rest did not show any clear ERP differential. Further analyses confirmed the presence of both a negativity and a positivity in the native group but only a positivity in the non-native group[6]. As mentioned

in the introduction, many studies have shown that late bilinguals do not anticipate upcoming words to the same extent as native speakers (Dussias et al., 2013; Gruter et al., 2012; Hopp, 2013; Lew-williams & Fernald, 2011; Martin et al., 2013, but see Foucart et al., 2014). Even though low constraint sentences like the ones we used do not allow anticipation of a specific word, if native speakers hear the sentence 'I like to drink...' produced by an adult, as soon as they reach the verb 'drink' they will automatically activate a cohort of words related to beverages an adult would have (e.g., water, beer, wine). The activation of potential upcoming words is facilitated by 1) the frequency with which native speakers hear these combinations of words (e.g., I like to drink wine); 2) by the rapid use of semantic and pragmatic information that allow reducing the cohort of words (i.e., the word 'milk' is less likely to be activated if the sentence is produced by an adult than by a child). Conversely, anticipating words in L2 may be more difficult because of less frequent occurrences of word combinations and slower use of semantic and pragmatic information (see Kaan, 2014 for a review on predictive processing in L2). If semantic and pragmatic information do not interact to the same extent in sentence processing in L1 and L2, non-native speakers might not be able to use the pragmatic information provided by the sentence context to reduce the cohort of potential upcoming words according to the person who speaks (i.e., the word 'milk' would be equally activated independently of whether the sentence is produced by an adult or a child). Hence, if non-native speakers do not generate pragmatic expectations from the sentence context, pragmatic inconsistencies will not trigger a negativity reflecting integration difficulty. In sum, the earlier onset of the LPP we observed in the non-native group may be due to the fact that no negative modulation masked the onset of the LPP (as hypothesised for the native group). This is consistent with a recent hypothesis that puts forward that non-native speakers have Reduced Ability to Generate Expectations (RAGE; Grüter & Rohde, 2013) and that predictive mechanisms in native and non-native speakers are not different in nature but

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vary in the way they are driven (Kaan, 2014). Note that the presence of an LPP in some native speakers (see footnote 6) is consistent with previous studies showing individual differences in relation to word anticipation in native speakers, with reduced effect of anticipation in readers with smaller vocabulary (Borovsky, Elman, & Fernald, 2012), low-literate readers (Mishra, Singh, Pandey, & Huettig, 2012) or older readers (DeLong, Groppe, Urbach, & Kutas, 2012).

To conclude, the present study reveals that late bilinguals incrementally take into account the speaker's identity when interpreting the message during sentence listening. The results indicate that they are able to process various sources of information during sentence processing similarly to native speakers. The effects observed suggest that late bilinguals process semantic and pragmatic information incrementally; however, what seems to differ between L1 and L2 processing is the time-course of the different processes. We propose that this difference may be due either to the fact that late bilinguals rely more on easily accessible information (e.g., pragmatic information) when having to process various sources information, or that they do not use the information provided by the sentence context as efficiently as native speakers to be able to generate expectations in relation to pragmatic information to the same extent. Further research investigating the time-course of the different processes occurring in L2 sentence comprehension is needed. Note as well that the results suggest individual differences play a role in sentence comprehension and thus, they should be taken into consideration when investigating language processing, both in L1 and L2.

Acknowledgements

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Appendix. Experimental sentences sorted by type of inconsistencies. The "/" separate the

Consistent speakers (Inconsistent speaker) condition and Semantic violation. Critical

words are underlined. The close English translation is given in italics.

Consistent (child) – Inconsistent (adult)

Me gusta jugar a gánsteres/narices y policías con mis amigos.
I like playing gangsters/noses and police officer with my friends.

Mis historias favoritas son aquellas con hadas/mantequilla y un príncipe azul.
My favourite stories are those with fairies/butter and Prince Charming.

Hemos estado jugando con mis padres al escondite/techo durante toda la mañana..
We've been playing with my parents hide-and-seek/ceiling all the morning.

Empujé a mi hermano porque no me devolvía mi juguete/uña y se quejó a mama.
I pushed my brother because he didn't give me my toy/nail back and he complained to our mum.

No puedo dormir sin mi osito/ruido de peluche entre los brazos.
I can't sleep without my teddy bear/noise in my arms.

Me pican mucho las manchas rojas de la varicela/botella y no puedo parar de rascarme.
They are very itchy, the red chicken pox/bottle marks and I can't scratch them.

Como es mi cumpleaños, llevaré a mis amigos unos caramelos/cables y regaliz.
Since it's my birthday, I will bring my friends some sweets/wires and liquorice.

Quiero ir a la playa para hacer castillos/abrigos de arena y jugar con mis hermanos.
I want to go to the beach to build sand castles/coats and play with my brothers.

Dejé de dormir con pañal/plato hace dos años.
I stopped sleeping with diapers/plates two years ago.

Aprenderé a hacer sumas y multiplicaciones/pulmones de aquí a unos días.
I will learn to do additions and multiplications/lungs within few days.

Me gustaría aprender a ir en bicicleta/limón y poder ir a dar una vuelta con mi familia.
I'd like to learn to ride my bicycle/lemon and go for a ride with my family.

Estoy esperando a que me caiga el diente/movimiento para ponerlo bajo la almohada.
I'm waiting for my tooth/movement to come out to put it under my pillow.

Me encanta jugar con mis Barbies/abogadas y jugar a ser hermanas.
I love playing with my Barbies/layers and pretend to be sisters.

Ayer jugué con mi muñeca/carpeta y le corté el pelo.
Yesterday I played with my doll/folder and cut her hair.

Mañana es mi último día de vacaciones, tengo que volver al colegio/cinturón pero no quiero.
Tomorrow is my last day of vacations, I have to go back to school/belt but I don't want to.

Mi hermana me dice que empiezo a ser una adolescente/pato porque estoy muy pesada.
My sister tells me I'm turning into an adolescent/duck because I'm very irritating.

Siempre que puedo cambio el canal de televisión para poner los dibujos/muebles y pasar un buen rato.
As soon as I can I change the TV channel to watch some cartoons/furniture and have good fun.

Estoy moviendo la tierra del jardín para poner un tesoro/nube y jugar a piratas.
I'm moving the garden soil to bury a treasure/cloud and play pirates.

Lo mejor de Ana es cuando me explica un cuento/vapor para dormir.
The best thing with Ana is when she tells me a tale/steam to go to sleep.

Preguntaré a mi madre si me da permiso/pared para salir hasta la diez.
I'll ask my mother if she grants me permission/wall to go out until 10pm.

Me encuentro mal hoy, tendré que ir a mi pediatra/oeste otra vez.
I'm not feeling well today, I'll have to go to my paediatrician/west again.

Me han dicho que los bebes los llevan las cigüeñas/botas, ¡debe ser difícil para ellas!
I have been told babies are carried by storks/boots, it must be very difficult for them!

Me gusta coger el jabón y soplar burbujas/maletas cuando me baño.
I like grabbing the soap and blowing bubbles/suitcases when I'm having a bath.

Me molestan los ruidos de la cama porque tengo debajo unos monstruos/mundos horribles.
The noises under my bed annoy me because there are some horrible monsters/worlds.

Me he ido de casa porque no me dejan ver esa película para mayores/centres y estoy aburrida.
I left home because they won't let me watch that film for adults/centres and I'm bored.

He estado hablando con el compañero y me han castigado/desordenado sin patio.
I was talking to a classmate and I got punished/untidy. No playing in the yard.

El año pasado dejé de usar el chupete/cielo para dormirme.
Last year I stopped using my pacifier/sky to go to sleep.

Consistent (adult) – Inconsistent (child)

Estoy triste por mi jubilación/verde este año.
I'm sad about my retirement/green this year.

Mis programas favoritos de televisión son las noticias/silencios que ponen por el mediodía.
My favourite TV programs are the news/silences they broadcast at midday.

Como me gusta estudiar, estoy haciendo un curso de profesor/saldad en matemáticas pero es muy difícil.
As I love studying, I'm taking a course as a Maths teacher/salad but it's very difficult.

Hoy tengo una fiesta con mis amigos. Llevaré cerveza/fábrica, soda y patatas.
Today I'm partying with my friends. I'll bring some beer/factory, soda and chips.

Mis programas de televisión favoritos son debates de actualidad/neveras y documentales de flora y fauna.
My favourite TV programs are debates on topic/fridge and flora and fauna documentaries.

Hay elecciones al ayuntamiento este año. Voy a presentarme/comer como el candidato republicano.
This year, there are city hall elections. I'll stand/eat for elections as the republican candidate.

Mañana al mediodía me casaré/graparé en un hermoso castillo.
Tomorrow at midday I'm getting married/stapled in a beautiful castle.

Siempre leo el periódico/pan mientras desayuno.
I always read the newspaper/bread while having breakfast.

El doctor me dijo que descansara porque tengo demasiado estrés/anuncio últimamente.
The doctor told me to rest because I have too much stress/advertisement lately.

El año que viene solicitaré plaza/glass en la universidad y eso me pone muy nervioso.
Next year I'll apply for a place/glass at the university and this is getting me nervous.

Cada noche bebo un poco de vino/tarjeta antes de ir a dormir.
Every night I drink a little bit of wine/credit card before going to sleep.

Me gusta ir a la ópera/tenedor con mi novia.
I'd like to go to the opera/fork with my girlfriend.

Esta mañana me he tomado un café/pelo y dos rebanadas de pan.
This morning I drank a coffee/hair and two loafs of bread.

Tengo que salir a hacer una pausa y un cigarro/caballo tranquilamente.
I need to get out and have a break and a cigarette/horse peacefully.

Para comer tengo ostras/plástico y pescado.
For lunch I have oysters/plastic and fish.

Siento el principio de la menopausia/fantasma en mi cuerpo.
I'm feeling the beginning of the menopause/ghost in my body.

Intento evitar tener deudas/rombos con mis amigos.
I try to avoid debts/rhombus with my friends.

Me gusta ir de bares/vegetales con mis amigos.
I like going to bars/vegetables with my friends.

Hablo mucho con mi hijo/valle los fines de semana.
I talk a lot to my son/valley during the weekends.

Estoy ahorrando para un aumento de labios/lápices porque no me gusta cómo son.
I'm saving up for lip/pencils augmentation because I don't like how they are.

Tengo un montón de canas/suelos y lo odio.
I have a lot of grey hair/floor and I hate it.

Cada lunes por la mañana tengo un montón de reuniones/espirales y se hace muy duro.
Every Monday morning I have a lot of meetings/spirals and it's very hard.

Hace unos años me di cuenta de que he empezado a perder pelo/pimienta y eso no me gusta.
Few years ago I realized that I started to lose hair/pepper and I don't like it.

Por desgracia, he perdido mi trabajo/cueva hoy.
Unfortunately, I lost my job/cave today.

Voy a presentar mi tesis/aleteo por Europa para encontrar trabajo.
I'll defend my thesis/flutter for Europe to find a job.

Este año crearé una nueva empresa/atmósfera con mi hermano.
This year I'll set up a new company/atmosphere with my brother.

Me siento libre y feliz cuando voy a la discoteca/abrigo los viernes.
I feel free and happy when I go to the disco/coat on Friday.

En mis ratos libres me gusta leer ensayos/pájaros y cómics.
In my free time I like reading a essays/birds and graphic novels.

El domingo pasado jugué a golf/gas con un amigo mío.
Last Sunday I played golf/gas with a friend of mine.

Me encantan los perros. Tengo dos rottweilers/olas que me llevo a todas partes.
I love dogs. I have two Rottweiler/waves that I take everywhere.

Me están empezando a salir arrugas/habitaciones alrededor de los ojos.
Some wrinkles/rooms are starting to appear around my eyes.

Hace ya un año que estoy prometida/amarilla y me gustaría casarme pronto.
It's been a year already since I've been engaged/yellow and I'd like to get married soon.

Mis amigos y yo vamos a clubs de striptease/jirafa o bares toda la noche.
My friends and I go to strip/giraffe clubs or bars all night.

Quiero recortarme la barba/rata después de haberla llevado unos años.
I want to trim my beard/rat after having had it long for years.

La tira/arte de mi sujetador está rota.
My bra/art strip is broken.

Cada sábado quedo con mis amigos para hablar de filosofía/marrón y política.

Every Saturday I meet up with my friends to talk about philosophy/brown and politics.

Paso un montón de tiempo en el ordenador apostando/bañandome en internet y normalmente gano.
I spend a lot of time betting/bathing on the Internet and I usually win.

Cuando vine aquí, ya hacía dos años que vivía sola/azul en el barrio.
When I came here, I had been living alone/azul I the neighbourhood for two years.

Me hice daño reponiendo las ruedas/arcoíris de mi coche tuneado.
I hurt myself changing the tires/rainbow of my tune-up car.

Me he dado cuenta de que mi nieto/meteorito es muy inteligente.
I realised that my grandchild/meteorite is very clever.

Consistent (male) – Inconsistent (female)

Esta mañana he ido al hospital para hacerme una exploración de próstata/búfalo porque me duele.
This morning I went to the hospital to have my prostate/buffalo checked because it hurts.

Como me gusta explicar historias a los niños, soy un abuelo/zapato querido.
I like telling stories to children; I'm a loved grandfather/shoe.

Llegué a casa después de tres horas jugando a fútbol/delfín en el parque.
I arrived home after three hours playing football/dolphin at the park.

La mejor forma de empezar el día es conduciendo mi tractor/taza por los campos.
The best way to start a day is driving my tractor/mug through the fields.

En las reuniones del trabajo, siempre debo llevar corbata/lámpara y americana.
In work meetings, I always wear a tie/lamp and a suit.

Para mi cumpleaños mi mejor amigo me regaló un taladro/ruido y un llavero.
For my birthday my best friend gave me a drill/noise and a keychain.

Mañana antes de ir a trabajar tendré que afeitarme/elevarme y desayunar fuerte.
Tomorrow, before going to work, I'll have to shave/raise and have a good breakfast.

Cada día desayuno con mi mujer/decsión en una cafetería.
Everyday I have breakfast with my wife/decision in a café.

Cada domingo juego a rugby/pomo con unos amigos.
Every Sunday I play rugby/doorknob with friends.

Mi película favorita es Transformers/ensalada y la veo siempre que puedo.
My favourite film is Transformers/salad and I watch it whenever I can.

Los fines de semana suelo ir a cazar/rotar ciervos al bosque.
At the weekend I usually go hunting/rotating deers in the forest.

Acabo de conseguir trabajo como fontanero/fruta en una pequeña empresa familiar.

I've just got a job as a plumber/fruit in a little family business.

En el futuro quiero ser un buen futbolista/borrador y marcar muchos goles.
In the future I want to be a good football player/eraser and score a lot.

Cada día voy a la plaza en monopatín/tortuga y es muy emocionante.
Every day I go to the square with my skateboard/turtle and it's very exciting.

Mis deportes favoritos son el boxeo/odio y el fútbol.
My favourite sports are boxing/hatred and football.

Tengo problemas de erección/contador a causa del estrés.
I have erection/meter issues because of stress.

Me gusta hablar con mujeres atractivas/asfaltadas en las fiestas.
I like talking to attractive/asphalted women at parties.

Cuando sea mayor me gustaría ser cantante, bombero/ratón o doctor.
When I grow up I'd like to be a singer, fire fighter/rat or a doctor.

Me gusta dibujar y los colores que más me gustan son el negro/mesa y el amarillo.
I like drawing and my favourite colours are black/table and yellow.

Es verdad que tengo un bigote/trueno bastante largo pero lo dejaré crecer aún un poco más.
It is true that my moustache/thunder is quite long, but I'll let it grow a little bit more.

Me apasionan mucho los coches/boredom, especialmente los de época.
I'm passionate about cars/boredom, specially clasic ones.

Por mi trabajo paso un montón de tiempo viajando en el camión/estimulo de la empresa.
For work I spend a lot of time travelling in the company's truck/stimuli.

Los fines de semana me gusta mirar boxeo/enanos con mis amigos.
At the weekend I like watching boxing/dwarfs with my friends.

Nada más examinarme, el doctor descubrió que en mi testículo/vaca hay una malformación.
The doctor examined me and discovered that there was a malformation in one of my testicles/cows.

Consistent (female) – Inconsistent male)

En la peluquería pido que me hagan un alisado/bistec cada mes.
At the hairdresser's I ask them to straighten/steak my hair every month.

El doctor dijo que tengo cáncer de ovarios/router pero que tiene solución.
The doctor told me I had ovary/router cancer, but it is curable.

Esta noche mi marido/cola me ha sugerido que cambie de trabajo.
Tonight, my husband/tail suggested that I change my job.

Me gusta llevar medias/charcos marrones con mis botas nuevas.
I like wearing brown tights/ponds with my new boots.

Odio cuando los hombres se fijan en mi escote/células más que en mis ojos.
I hate when men look at my cleavage/cells more than my eyes.

Me gusta hacer bizcochos/ratones y tomar café con mis amigas.
I like baking cakes/rats and drinking coffee with my friends.

Me hice una revisión en la consulta del ginecólogo/trompeta hace dos días.
I did a check-up at the gynaecologist/trumpet two days ago.

Antes de salir siempre compruebo que mi maquillaje/apodo esté bien.
Before leaving I always check that my make-up/nickname is fine.

Mi trabajo como profesora/cazo de guardería es realmente perfecto para mí.
My work as a kindergarten teacher/pot is perfect for me.

Mis colores favoritos son el rosa/sal y el verde manzana.
My favourite colours are pink/salt and apple green.

Tengo una cita con la esteticista/martillo a las cinco.
I have an appointment with the beautician/hammer at five.

Para la fiesta de cumpleaños de mi amiga iré disfrazada de princesa/pestaña o de hada.
To go to my friend's birthday party I'll dress up as a princess/eyelash or fairy.

¡Ojalá me pareciera a Madonna/botón en su último video!
I wish I was like Madonna/button in her last video.

Para mi cumpleaños mis amigos me regalaron un maquillaje/molécula nuevo.
For my birthday, my friends gave me some new make-up/molecule.

Mañana he quedado con unas amigas para ir de compras/ventanas al centro comercial.
Tomorrow I'm meeting some friends to go shopping/window to the mall.

Quería hacer algo de deporte y decidí asistir a clases de baile/candidato por la tarde.
I wanted to do some sport and I decided to attend dance/candidate classes in the afternoon.

El fin de semana suelo mirar películas románticas/olorosas con una tarrina de helado.
During the weekend I usually watch romantic/smelly films with some ice cream.

Este fin de semana me haré mi manicura/cable mensual y me cortaré el pelo.
This weekend I will have my monthly manicure/wire done and my hair cut.

Cada año voy a hacerme una revisión al ginecólogo/papel y al médico de familia.
Every year I get checked-up at the gynaecologist/paper and at the GP.

Siempre he querido ser madre/fruta porque me encantan los niños.
I've always wanted to be a mother/fruit because I love children.

Opino que mi primer embarazo/tierra fue muy duro.

I think that my first <u>pregnancy/earth</u> was very tough.

El doctor encontró un tumor en mi <u>útero/cocina</u> ayer.
The doctor found a tumour in my <u>utero/kitchen</u> yesterday.

Es muy bonito cuando mi pareja me regala <u>flores/basura</u> sin que lo espere.
It is very nice when my partner gives me <u>flowers/rubbish</u> without me expecting it.

Anoche me compré un <u>pintalabios/tormenta</u> muy bonito en la tienda.
Yesterday night I bought a very beautiful <u>lipstick/storm</u> at the shop.

Me están creciendo los <u>pechos/carreras</u> y los chicos se fijan en mi.
My <u>breast/race</u> is growing and boys pay attention to me.

Esta mañana me he comprado un <u>vestido/alma</u> en una tienda nueva cerca de casa.
This morning I bought a <u>dress/soul</u> in a new shop near my house.

Para la fiesta de mi amigo me compraré unos <u>tacones/lagartos</u> que vi en un escaparate.
For my friend's party I'll buy some <u>high-heels/lizards</u> that I saw in a shop window.

Estoy entrenando mucho para la competición de natación <u>sincronizada/seca</u> con mi equipo.
I'm training a lot for a <u>synchronized/dry swimming</u> competition with my team.

Mi hermana y yo siempre nos dejamos los <u>tacones/pulmones</u> para salir.
My sister and I always borrow each other's <u>high-heels/lungs</u> to go out.

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[1] Spanish native speakers were tested in Barcelona, a bilingual area of Spain; hence, they had Catalan as an L2. As suggested by a reviewer, the use of pragmatic cues could affect both L1 and L2 processing in bilingual speakers. The present experiment does not allow us to discard this possibility. However, since participants were tested in their L1 and their results are consistent with previous studies involving monolinguals, we are fairly confident that if L1 processing is indeed affected it is so to a limited extent.

[2] In the cloze-probability test, participants were presented with the experimental sentences up to the word preceding the critical word. They were asked to complete the sentence with the first word that came to their mind. The cloze probability of a noun was defined as the percentage of times it was used.

[3] Preliminary analyses revealed that the factor Hemisphere (with regions depicted in the Figure) did not reach significance and did not interact with the factor Condition so we removed this factor from further analyses.

[4] Time-window 100-400 ms. The main effect of Group was significant ($F(1, 46) = 5.86$, $p. = .02$) but it did not interact with Condition. The main effect of Condition did not reach significance ($F(2, 92) = 0.82$, $p. = .44$). The interaction Consistency x Region tended towards significance ($F(4, 184) = 2.19$, $p. = .07$).

[5] Following a comment from an anonymous reviewer, we conducted an analysis involving Group (native vs. non-native) as a between-subject factor and Condition (CS vs. SV), Time-window (400-700 ms vs. 700-1200 ms) and Region as a within subject factor. This analysis revealed that the negativity was present in both groups in the 400-700ms time-window, however, larger for the native group ($p < .001$) than for the non-native group ($p = .05$), and that the effect lasted longer (until the 700-1200 ms time-window) in the non-native group ($p < .001$). The longer lasting effect may reflect more difficulty to process semantic incongruent sentences in L2 than in L1.

[6] To further investigate the variability of effects (positivity and negativity) observed from the individual data, we conducted further analyses. In the Central region (where the effects are observed), we calculated the difference between the CS and the IS conditions for both groups. We performed a median-split to divide each group into two sub-groups based on the negative or positive magnitude of the effect. This manipulation resulted into two sub-groups for the native speakers (Native-NEG and Native-POS) and two sub-groups for the non-native speakers (Non-Native-NEG and Non-Native-POS). An ANOVA in the 400-700 ms time-window including the factors Group and Condition revealed a significant main effect of Condition ($F(1, 44) = 13.05$, $p < .001$, $\eta^2 = .23$) and an interaction Group x Condition ($F(3, 44) = 29.98$, $p < .001$, $\eta^2 = .67$). Post-hoc (Bonferroni) analysis showed a significant effect for Native-NEG ($p < .001$), Native-POS ($p < .001$) and Non-Native-POS ($p < .001$), but not for Non-Native-NEG ($p < 1$).

When contrasting the native sub-groups (NEG vs. POS), only the interaction Group x Condition was significant ($F(1, 21) = 39.08$, $p < .001$, $\eta^2 = .65$), not the main effect of Condition ($F(1, 21) = 0.08$, $p = .78$, η^2

= .003). In the non-native sub-groups, both the main effect of Condition ($F(1, 23) = 27.26$, $p < .001$, $\eta^2 = .54$) and the interaction ($F(1, 23) = 35.57$, $p < .001$, $\eta^2 = .61$) were significant. These results confirm the present of both a negativity and a positivity in the native group, but only a positivity in the non-native group.