Highlights

- Agreement is a syntactic relation involving e.g. matching nouns and verbs.
- It is unclear if verbal morphology depends on the noun or is independent.
- We manipulated the semantic markedness of nominal and verbal inflection in Basque.
- ERPs show that interpretation is influenced by the position of marked morphology.
- Findings point to verbal morphology as syntactically independent.

***Title page**

Agreement and illusion of disagreement: an ERP study on Basque

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Abstract

Agreement is a syntactic relation involving a controller (e.g. a noun) and a target with matching inflectional morphology (e.g. a verb). Across languages, electrophysiological studies consistently report that the presence of a mismatch yields late positive effects (P600), often preceded by early negativities. The current study focuses on person agreement in Basque to investigate whether online processing routines are modulated by the relative semantic prominence of nominal and verbal person features. In an ERP experiment in Basque, we manipulated the semantic markedness of nominal and verbal person features, creating 1st (marked) and 3rd (unmarked) person correct and incorrect sentences [*Japoniarrok$_{1pl}$ euskara ikasi dugu$_{1pl}$ /*dute$_{3pl}$ gustora* (We Japanese have$_{1pl/*3pl}$ learn Basque with pleasure); *Japoniarrek$_{3pl}$ euskara ikasi dute$_{3pl}$* /*dugu$_{1pl}$ gustora (The Japanese have$_{3pl/*1pl}$ learnt Basque with pleasure)]. Both mismatches elicited an N400 effect, but only marked 1st person mismatches (Japoniarrok$_{1pl}$ … *dute$_{3.pl}$) generated a P600, suggesting that (i) mismatches with unmarked 3rd person subjects (*Japoniarrek*$_{3.pl}$ … **dugu*$_{1.pl}$) are not treated as outright violations; (ii) the emergence of late positive effects is sensitive to fine-grained discourse information. Overall, these results call for a revision in the analysis of agreement relations from a theoretical and a processing perspective.

Key words: Basque, agreement, person, P600, N400

INTRODUCTION

Agreement is a syntactic relation that involves a controller, such as a noun (the $boy_{3.sg}$), and a target, such as a verb ($jumps_{3.sg}$), with matching inflectional morphology. Nevertheless, an inherent interpretive asymmetry characterizes the controller-target relation: the systematic covariance in person and number tells the parser something about the noun (which refers to a contextually defined individual involved in a jumping event) but not about the verb. It is still a matter of debate whether such an interpretive asymmetry has also reflexes in the syntactic computations that underlie the establishment agreement relations. Feature-copying approaches to agreement (Chomsky, 1995, 2000) assume that this is indeed the case: verbal inflectional morphology is dependent on the feature specifications of the nominal argument, from which it is copied. This contrasts with approaches proposing the independent and symmetric generation of nominal and verbal features, and the subsequent spreading of feature values between the two elements (Ackema & Neeleman, 2013; see also unification-based analyses such as Pollard & Sag, 1994).

The current event-related potentials (ERP) study investigates the relative weight of nominal and verbal person inflection in the interpretation of subject-verb agreement relations. Critically, we show that the contribution of the two elements to the interpretation of an agreement relation is determined by their relative semantic prominence, or markedness, which shapes processing routines to the extent that the parser can tolerate deviations from standard agreement patterns.

Person asymmetries

Typological and generative approaches to agreement converge in that person is the most relevant piece of information for the interpretation of an agreement dependency, as it

contains the information necessary to understand who the participants are (the speaker, the addressee) and whose perspective the event is narrated from.

A fundamental semantic opposition exists between 1st and 2nd person on the one side, and 3rd person on the other. While the former index two individuals actively taking part in the speech event – the speaker and the addressee, respectively- the latter refers to the entity whom speaker and addressee talk about, that is to say a non-participant person (Benveniste, 1966; Forcheimer, 1953; Jakobson, 1971). Intrinsic in the asymmetry between participants and non-participant person features is the notion of markedness. Since 1st and 2nd person possess the property determining the inherent opposition between person values, they are regarded as semantically marked, unlike 3rd person, which is considered the unmarked or default person specification (Benveniste, 1966; Harley & Ritter, 2002; Sauerland, 2008).

Semantic asymmetries are also found among plural person values. Since 1st and 2nd person singular index unique entities, their plural counterparts cannot be regarded as *augmentative* forms, that is mere multiplications of their singular counterparts. Rather, 1st and 2nd person plural forms denote the *association* of different individuals bearing different speech act roles. In other words, *We* and You_{plur} have an *associative*, rather than plural meaning (Cysouw, 2003): the protypical meaning of *We* can be indicated as 'I and my associate(s)', in which the associate can be either the addressee or another entity (ex: We = I + you/I + he), while the meaning 'You and your associate(s)' can be applied to You_{plur} (ex: You_{plur} = you_{sg} + he/they). It follows that the word 'plural', when part of the terms 1st and 2nd person plural, is nothing but a misnomer (Benveniste 1966; Cysouw 2003; Harley and Ritter 2002; Wechsler 2004). On the contrary, 3rd person plural forms are truly augmentative forms, since shifting from *He/She/It* to *They* implies no modification of the speech participants makeup, as only individuals with no speech roles are involved. Within a speech event, only one speaker and one addressee can be present, but there can be

more than one entity being talked about: hence, the availability of a true plural form for 3rd person.[1]

Person agreement processing

Although subject-verb agreement is one of the most studied phenomena in psycholinguistics, little attention has been paid to how person agreement is processed. Studies on person agreement have mostly focused on the processing of subject-verb anomalies that involved the contrast between either a non-participant argument vs. a verb invoking the presence of a speaker/addressee (3rd person singular vs. 1st/2nd person singular, Spanish: Hinojosa et al. 2003; Mancini et al. 2011a) or an addressee-related subject followed by a speaker-related verb (2nd person singular vs. 1st person singular, Basque: Zawiszewski et al. 2016; person+number: Zawiszewski & Friederici, 2009)[2]. Because singular person features refer to atomic individuals/entities (Heim, 2008), the contrast between a 3rd person singular subject and a 1st/2nd person singular verb is one between two roles that are incompatible for the same individual. An outright mismatch is detected that leads the parser to the impossibility to assign a discourse role to the subject argument, and hence to interpret the sentence.

[1] A true 1st person plural may be claimed to exist as a conceptual category. If we interpret 1st person singular as making direct reference to the speaker, we can conceive of 1st person plural as referring to a mass of speakers, a group of people speaking together in unison. Mass speaking, as happens in church services, concerts or sport matches, is one such circumstance under which one can talk about a true 1st person plural. Along the same lines, one can identify a true 2nd person plural in the use of *You* to address an audience, as happens in a class when addressing all the students present at the time of utterance. In both cases, one is faced with conceptual categories that are not grammaticalized in any language: so far, no language has been found that distinguishes the mass speaking meaning from the associative meaning of *We*, or the audience address meaning from the associative meaning of *You* (see Cysouw 2003 and references cited therein).

[2] Silva-Pereyra & Carreiras (2007) created person anomalies between subject and verbs using 1st, 2nd and 3rd singular and plural pronouns, followed by either singular or plural person-mismatching verbs.

The N400-P600 ERP pattern reported for Basque and Spanish (Mancini et al. 2011a, Mancini et al. 2011b; Zawiszewski et al. 2016; Zawisezewski & Friderici, 2009) supports this analysis. Existing studies and processing models converge in interpreting early negative effects as indices of checking operations that are performed by the parser to verify the consistency between nominal and verbal features upon establishing an agreement relation (Friederici, 2002, 2011; Molinaro et al. 2011, 2015). Because N400 effects are typically associated with processing at the lexico-semantic level, it has been suggested (Mancini et al. 2011a) that the N400 arising for person anomalies is driven by the impossibility to map morphosyntactic information onto the corresponding semantic-discourse information that the parser uses to assign speaker, addressee or non-participant discourse roles to the subject.

As for late positive effects, these are commonly regarded as electrophysiological signatures of repair/reanalysis operations triggered by the presence of a morphosyntactic anomaly (Bornkessel-Schlesewsky & Schlesewsky, 2006; Friederici, 2002, 2011; Hagoort, 2005). Lately, however, the discovery of P600 effects in the presence of non-linguistic stimuli (Lelekov et al. 2000; Nuñez-Peña & Honrubia-Serrano, 2004; Patel et al. 1998; see Swaab et al. 2012 for a review) has led to reconsideration of the functional significance of late positivities in terms of domain-general conflict-monitoring processes (van de Meerendonk et al., 2009). From this perspective, P600 effects would reflect reanalysis after a strong conflict has been detected between the top-down expectations and the bottom-up analysis of the perceived input (van de Meerendonk et al., 2009). Importantly, monitoring is not to be seen as a comparison process. After an error has been detected, processing continues and the correct response is coactivated internally. A conflict arises that, when exceeding a certain threshold, triggers repair and reanalysis procedures. In other words, a strong violation of expectancy is necessary to create a conflict that is powerful enough to elicit repair and reanalysis (van den Meerendonk et al. 2009).

The current study

The studies reviewed above have made it possible to isolate the processing correlates associated with outright morphosyntactic and discourse incompatibility between subject and verb person specifications. However, little is known about what happens when the overall discourse representation can accommodate multiple entities with discourse participant and non-participant roles, such as when associative and augmentative persons are involved. A legitimate question to ask is whether, in such contexts, the parser attempts at integrating the two mismatching person specifications in the same discourse representation, and whether the semantic opposition between participants and non-participants plays any active role in this.

Central to this hypothesis is the observation that syntactic violations are more likely to be tolerated when they result in a meaning that cannot be expressed by alternative syntactic structures (Ackema & Neeleman, 2013; see Fanselow, 2004 and Clifton, Fanselow and Frazier, 2006 for violations of wh- movement in questions that result in tolerated structures). In other words, whenever there is no other way to express a certain meaning, syntactic principles need not be respected, and anomalies may be “amnestied”. Along similar lines, Ackema and Neeleman (2013) have proposed that feature mismatches in subject-verb agreement relations may be tolerated when the verb supplies a more specific (or marked) interpretation to the subject. This way, mapping from morphosyntax to semantics is maximized and as little information as possible is lost. More concretely, if the verb has a more marked person value than the subject, this reading is adopted and extended to the subject (see also Halle & Marantz, 1993 and Kiparsky, 1973 for similar principles). Support for this analysis comes from the presence of grammatical person mismatches such as Spanish unagreement (Hurtado, 1985), where the more marked 1st

person plural reading of the verb is adopted to narrow down the reading of the 3rd person plural subject, as in 1a (compared to 1b). Critically, this does not occur in 1c: the non-participant status of an atomic individual cannot be changed to the more specific role of addressee, with the consequence that no discourse role can be assigned to the subject of the sentence.

UNAGREEMENT

1. a. Los lingüistas$_{3.pl}$ escribimos$_{1.pl}$ un artículo muy interesante
   We linguists wrote a very interesting article

STANDARD AGREEMENT

   b. Los lingüistas$_{3.pl}$ escribieron$_{3.pl}$ un artículo muy interesante
   The linguists wrote a very interesting article

PERSON VIOLATION

   c. *El lingüista$_{3.sg}$ escribiste$_{2.sg}$ un artículo muy interesante
   *The linguist wrote a very interesting article

This hypothesis has important processing implications, as it predicts that the processing routines associated with agreement comprehension can be shaped by the semantic-discourse representations of plural subjects and verbs. Critically, unagreement was investigated in a recent study by Mancini and colleagues (Mancini et al. 2011b). Similarly to person anomalies, unagreement (relative to standard agreement) elicited an early negative effect between 300 and 500 milliseconds after verb presentation, suggesting the detection of a mismatch between subject and verb. However, in line with its grammatical status, unagreement (relative to standard agreement) did not elicit a P600 effect. Rather, in the time interval usually associated with the early phase of the P600 (500-700 milliseconds), a sustained negativity was evident, which the authors interpreted as evidence for the suppression of repair operations. These results are therefore compatible with the view that person mismatches in the plural can be resolved by adopting the more marked person reading available in the sentence, narrowing down the group of referents

referred to by the 3rd person plural subject (i.e. a group of linguists that includes the speaker of the sentence). Indeed, Mancini et al. (2011b, 2013) account for unagreement in terms of a mechanism dubbed as Reverse Agree. This operation hinges precisely on the unmarked vs. marked opposition between subject and verb, which triggers the overwriting of marked verbal onto unmarked nominal features, thus shifting the interpretation of the subject from 3rd to a 1st person plural.

Crucially, the study by Mancini et al. (2011b) only provides a partial view of the phenomenon. Firstly, the unequivocal grammatical status of Spanish unagreement does not allow us to conclude whether the mechanism by which the parser integrates the subject's and the verb's discourse representations characterizes the processing of plural person mismatches across the board. In other words, it is unclear whether a general cognitive mechanism is available that attempts at "amnestying" deviations from a default rule, in order to maximize information mapping whenever possible. Under this hypothesis, one should expect this mechanism to be operative also in ungrammatical sentences that present a similar configuration and person marking contrasts. Secondly, in Mancini et al. (2011b), unagreement could not be compared to mismatching patterns with a 1st person plural controller, to assess whether tolerance towards a mismatch arises as a function of the position of the more marked person feature.

To answer these questions, we investigated person agreement processing in Basque, a head-final language spoken in the northeast part of Spain and southwestern France. More concretely, we explored the processing of subject-verb associative and augmentative person mismatches in Basque by capitalizing on the morphological and interpretive contrast of two determiners: *-ok* and *–ek* (1st/2nd and 3rd person plural, respectively).

Basque determiners, such as *–a, –ak* and *–ek* in 2 below, are bound morphemes that attach to the noun phrase, carrying both number (singular vs. plural, -a/-e) and case

information (ergative vs. absolutive, -k/-ø). Alongside with these morphemes, the proximate or inclusive determiner –*ok* determiner in 3 is also found. This article replaces the plural articles –*ak*/-*ek* on a noun phrase when its referent is directly implicated in the speech and when marking the speaker's or the addresse's belonging to a specific group (de Rijk, 2008; Hualde & Ortiz de Urbina, 2003; Laka, 1996). For example, *-ok* in *gizonok* produces a 1st or 2nd person reading of the noun, that is "we/you men", emphasizing the speaker/addressee belonging to the group of men.

2. a. Gizon-*a* b. gizon-*ak* c. gizon-*ek*
   Man-the$_{sg.abs}$ men-the$_{pl.abs}$/man-the$_{.sg.erg}$ men-the$_{pl.erg}$

3. Gizon-*ok*
   Men – we/you men$_{abs/erg}$

The person and number information encoded by subject (and object) noun phrases is systematically mapped onto the morphology of the auxiliary verb: -ok triggers 1st or 2nd person plural inflection on the auxiliary verb, as illustrated in the transitive sentence in 4a, while ergative subjects marked with –ek are associated with 3rd person plural inflection on the auxiliary verb (5a). In standard Basque, the combination of an –ok marked subject with a 3rd person plural auxiliary, as in 4b, gives rise to a mismatching pattern that is regarded as ungrammatical, except for very restricted discourse contexts[3]. Similarly, in standard Basque, a configuration involving an –ek marked subject followed by a 1st person plural auxiliary (5b) is normally regarded as ungrammatical.

4. a. Ikastaroan japoniarr**ok**$_{1.pl}$ euskara ikasi$_{verb}$ **dugu**$_{aux.1.pl}$ gustora.
   In class we Japanese have learnt Basque with pleasure.

[3] De Rijk (2008) and Arregi (2001) describe the use of the proximate plural article in combination with 3rd person plural verbs. According to these authors, this use of –*ok* is meant to mark matters already mentioned in discourse. In other words, "*japoniarrok*" in "*Japoniarrok euskara ikasi dute*" would receive the reading of "the Japanese here". However, to our knowledge, this interpretation of the proximate plural article is not attested in standard Basque, the tested in this study, and it is limited to western varieties. All of the participants in this study were from the eastern part of the Basque Country.

b. *Ikastaroan japoniarr**ok**$_{1.pl}$ euskara ikasi$_{verb}$ **dute**$_{aux.3.pl}$ gustora.
*In class we Japanese have learnt Basque with pleasure.

5. a. Ikastaroan japoniarr**ek**$_{3.pl}$ euskara ikasi$_{verb}$ **dute**$_{aux.3.pl}$ gustora.
In class the Japanese have learnt Basque with pleasure.

b. *Ikastaroan japoniarr**ek**$_{3.pl}$ euskara ikasi$_{verb}$ **dugu**$_{aux.1.pl}$ gustora.
*In class the Japanese have learnt Basque with pleasure.

Basque proximate plural determiner *-ok* makes it possible to compare associative and augmentative person agreement mismatches using referential noun phrases (NPs). This allows us a more straightforward comparison with previous agreement- and unagreement-related studies, such as the one in Spanish by Mancini et al. (2011), and the testing of whether the position of the more marked person specification matters.

We hypothesized that the parser would rapidly detect a person agreement mismatch between subject and verb, both in the presence of an augmentative and an associative subject. An early negativity, plausibly an N400 effect, should therefore arise, in line with previous studies on person agreement (Mancini et al. 2011a, 2011b; Zawiszewski et al. 2016). In this temporal interval, no differences are expected between agreement mismatches involving associative and augmentative controllers. Yet, if the weight of nominal and verbal morphology changes as a function of their semantic markedness, 4b (relative to 4a) should give rise to qualitatively different effects compared to 5b (relative to 5a). More specifically, we expect that the analysis of a mismatch comprising an unmarked subject followed by a marked verb as in 5b will alert conflict-monitoring processes to a different degree compared to 4b, because of the more specific interpretation of the controller that can be generated in the former but not in the latter case. Three possible outcomes can be predicted. In one case, the processing of the two types of mismatches can give rise to topographically distinct P600 effects, with augmentative mismatches eliciting a reanalysis-related P600 with a prevalently anterior distribution (Friederici et al.

2002). Interestingly, anteriorly distributed P600 effects have been also associated with complexity at the discourse level (Carreiras et al. 2004; Kaan & Swaab, 2003), driven by the integration of new referents in the discourse representation underlying the sentence being parsed (see also Garrod & Sanford, 1994). In this respect, in 5b, the inclusion of the speaker invoked by the verb in the group referred to by the subject argument would instantiate a clear case of discourse model update that could trigger an anterior P600 effect. In contrast, the outright incompatibility of associative subjects with 3rd person plural verbs may engender a P600 with a posterior distribution typical of outright syntactic violations (Friederici et al. 2002; Hagoort & Brown, 2000; Osterhout & Holcomb, 1992).

A second hypothesis concerns potential differences between the two types of mismatches in the onset and amplitude of P600 effects. Previous studies on the role of feature markedness in the processing of agreement relations (Alemán Bañon & Rothman, 2016) have reported the timing and amplitude of P600 effects for number violations to be influenced by the morphological markedness of the target word, with greater and earlier effects for marked (*pastel…*asqueroso*, cake_{sg}…disgusting_{pl}) compared to unmarked violations (*pasteles…*asqueroso*, cakes_{pl}…disgusting_{sg}). In line with this, we may expect the timing and amplitude of the P600 elicited by marked anomalous *dugu* to differ from those of unmarked anomalous *dute,* leading to earlier and larger effects for the former compared to the latter verb form.

Alternatively, conflict-monitoring processes may not be alerted, because the adoption of the more specific reading of the subject occurs in the N400 time window. In this case, the emergence of a P600 effect is expected for associative subject violations, but not for augmentative ones, which may yield a sustained negativity. This outcome would be in line with data on Spanish by Mancini et al. (2011b), where the finding of a sustained negative

effect for unagreement relative to standard agreement was taken to suggest the inhibition of repair routines, because of the availability of an alternative grammatical analysis. [4]

Finally, if the weight of nominal and verbal person does not vary as a function of their semantic markedness, no differences should emerge between associative and augmentative person mismatches in the performance of either checking or repair/reanalysis mechanisms.

METHODS

Participants. Thirty-three native speakers of Basque from the University of the Basque Country (20 women; age: 18-35 years, mean: 26 years, SD: 3.4 years) took part in the experiment in exchange for small monetary compensation. All were healthy, right-handed and had normal or corrected-to-normal vision. Before the experiment, participants gave their informed consent. All participants were born and lived in the Basque Country and had started to speak Basque very early in life (mean 0.9 years, SD=1.12). The experiment was approved by the BCBL Ethics Review Board and complied with the guidelines of the Helsinki Declaration.

Materials. The experimental material consisted of 160 sentences divided into 4 conditions, as illustrated in Table 1. All sentences contained 6 words, of which the first one always represented a prepositional phrase (*ikastaroan*, in class), followed by a subject (*japoniarrok*, *japoniarrek, we/the Japanese*), a singular direct object (*euskara, Basque*), a

[4] As suggested by an anonymous reviewer, this hypothesis could in principle hold also for patterns in 4b, where a "the Japanese here" interpretation could be assigned (see footnote 3). We discarded this hypothesis based on three facts. Firstly, the participants tested in this study all came from the eastern part of the Basque country, while this reading of *–ok* subjects seems to characterize western varieties of Basque. Secondly, this interpretation is typically triggered in cases when it is clear that the speaker wants to mark matters already mentioned in discourse. As the sentences used in the experiment are decontextualized, it is unlikely that this interpretation was adopted by the participants. Finally, the unacceptability reported in the offline judgments (see Methods and Results section) confirms that speakers did not adopt this reading.

lexical transitive verb (*ikasi, to learn*), an auxiliary verb (*dugu/dute, have*$_{1pl/3pl}$), and an end-of-sentence adverbial phrase ("*with pleasure*"). First and 3rd person subjects were combined with 1st and 3rd person auxiliary verbs to create person agreement correct and incorrect sentences, in a 2 x 2 design, with Subject (2 levels: Associative, Augmentative) and Agreement (2 levels: Match, Mismatch) as within-subjects factors. Auxiliary verbs were matched in frequency (*dute*: 3.45, *dugu*: 3.32, based on E-Hitz, Perea et al., 2006). Eighty filler sentences (40 incorrect) were added with –ok and -ek marked subjects that could match or mismatch in person with the verb. This manipulation differed from the one used in the experimental items in that plural direct objects were used, which produced sizeable changes in the inflectional morphology of the auxiliary verb (singular object: *dute*$_{3pers}$/*dugu*$_{1pers}$; plural object: *dituzte*$_{3pers}$ /*ditugu*$_{1pers}$). Overall, a total of 240 sentences were administered to each participant.

Due to the predominant bilingual profile of Basque speakers in the Donostia-San Sebastián area, and thus to the close contact between Basque and Spanish, an offline acceptability judgment task was administered to 16 participants (11 woman, age: 19-31 yrs., mean: 25 yrs., SD: 3.9) that did not take part in the ERP study, to ensure that mismatching patterns with 1st and 3rd person subjects were really evaluated as ungrammatical. All participants were native speakers of Basque (AoA: 1.2 yrs, SD: 1.7) and reported to use Basque more predominantly than Spanish (Basque: 55%, Spanish: 47%). Participants judged Augmentative and Associative Mismatch sentences as incorrect in 78% (SE: 1.7) and 90% (1.2) of the cases respectively, while Augmentative Match and Associative Match were rated as correct in 85% (1.4) and 84% (1.4) of the cases.

Procedure. Participants were tested individually in a silent room. They were seated in front of a computer on which sentences were displayed word by word. Each word appeared in white on a black background and stayed on screen for 300 milliseconds, followed by a

400-millisecond blank screen. Sentence order was randomized. Participants were required to evaluate the acceptability of each sentence by pressing a YES-NO button on a joy-pad. Each session lasted about 2 hours, including preparation.

Table 1. Sample of experimental material. Asterisks indicate ungrammaticality [Ass.= Associative (1st person subject) (japoniarrok); Aug=Augmentative (3rd person subject (japoniarrek)].

	MATCH	**MISMATCH**
Ass.	Ikastaroan japoniarr**ok**$_{1.pl}$ euskara ikasi **dugu**$_{1.pl}$ gustora. In class we Japanese have learnt Basque with pleasure	*Ikastaroan japoniarr**ok**$_{1.pl}$ euskara ikasi **dute**$_{3.pl}$ gustora. *In class we Japanese have learnt Basque with pleasure
Aug.	Ikastaroan japoniarr**ek**$_{3.pl}$ euskara ikasi **dute**$_{3.pl}$ gustora. In class the Japanese have learnt Basque with pleasure	*Ikastaroan japoniarr**ek**$_{3.pl}$ euskara ikasi **dugu**$_{1.pl}$ gustora. *In class the Japanese have learnt Basque with pleasure

Electroencephalograph (EEG) recording. EEG was recorded with a 32-channels Brain Amp system. Twenty-eight electrodes were placed on an Easy Cap recording cap based on the 10-20 international system. Additional external electrodes were placed on the mastoids A1 and A2. Ocular electrodes (EOG) were placed above and below the right eye and on the left and right external canthi. EEG recording was referenced to right mastoid. Impedance was kept below 5Ω for mastoids and scalp electrodes, and below 10Ω for EOG ones. Data were acquired at a sampling rate of 250 Hz.

Data Analysis

Behavioral task. Mean accuracy and response times (RTs) for the acceptability judgment task were entered into a 2 x 2 ANOVA with Subject and Agreement as within-subject factors. Mean values and standard deviation are reported in Table 3 below.

EEG data. The EEG signal was filtered offline with a bandpass Butterworth filter (0.25-20 Hz) and then re-referenced to the average of the left and right mastoid. The signal was then inspected for ocular and muscular artifact.

Epochs of interest were selected time-locked to auxiliary verb presentation (-200 to 1000 ms). Artifact rejection led to a percentage of 10% of epochs (equally distributed across conditions, $F_{(3,33)}=0.31$, $p=0.8$) not considered for following analyses. After baseline correction, we calculated single-subject ERPs for each condition, which were used to calculate grand-averaged ERPs across subjects. Because the exclusion of incorrectly answered trials would have led to a significantly smaller number of observations for the associative mismatch condition compared to the other three conditions (see behavioral results below), both incorrectly- and correctly answered trials were included in the analysis.

ERPs were analyzed at auxiliary verb position (*dugu*/*dute*). A global four-way analysis of variance (ANOVA) was run with two experimental factors - *Subject* (Associative, Augmentative) and *Agreement* (Match, Mismatch) - as well as two topographical factors (see Table 2): *Region* (five levels: Frontal, Fronto-central, Central, Centro-Parietal and Parietal) and *Hemisphere* (two levels: Left, Right). Midline electrodes were analyzed separately (Fz, Cz, Pz, *FCP* factor). F-statistics relative to the global ANOVAs are reported in the text.

Statistics were performed on mean amplitude values in specific time windows of interest that have been associated with early negative (300-500 milliseconds) and late positive components (500-700 for early P600 effects, and 700-900 for late P600 effects, see Mancini et al. 2011a, 2011b; Molinaro et al. 2011, among others). Analyses were performed using R (version 3.5.0, The R Foundation for Statistical Computing).

Greenhouse-Geisser correction (Greenhouse-Geisser, 1959) was applied to all repeated measures with more than one degree of freedom in the numerator. Significant effects of the topographical factors are reported only when interacting with the experimental factors and are further disentangled with separate ANOVAs. T-values from pairwise post-hoc

comparisons were corrected using the False Discovery Rate procedure (Benjamini and Hochberg, 1995).

Table 2. Topographical factors included in the global four-way ANOVA

	Hemisphere	
Region	**Left**	**Right**
Frontal (F)	F3, F7	F4, F8
Fronto-central (FC)	FC1, FC5	FC2, FC6
Central (C)	C3, T7	C4, T8
Centro-parietal (CP)	CP1, CP5	CP2, CP6
Parietal (P)	P3, P7	P4, P8
Midline (FCP)	Fz, Cz, Pz	

RESULTS

Behavioral data

The analysis of accuracy revealed a main effect of Agreement [$F_{(1,32)}$=8.06, p<.001] and a Subject x Agreement interaction [$F_{(1,32)}$=6.45, p<.01], driven by the significantly less accurate evaluation of Augmentative Mismatch stimuli compared to Augmentative Match [$t_{(32)}$=3.47, p<.001]], and Associative Mismatch [$t_{(32)}$=2.69, p<.01]. No differences among conditions emerged from the analysis of RTs (Table 3).

Table 3. Mean accuracy and RTs (standard deviation in parenthesis; Ass = Associative; Aug = Augmentative)

Accuracy (%)			**RTs (msec)**		
	Match	**Mismatch**		**Match**	**Mismatch**
Ass	86 (13)	84 (16)	**Ass**	671 (204)	646 (214)
Aug	90 (12)	68 (42)	**Aug**	664 (183)	665 (204)

Event-related potentials

Three temporal intervals were analyzed: 300-500 milliseconds (for N400 effects), and 500-700 and 700-900 milliseconds (for P600 effects). Both mismatch conditions elicited early negative effects compared to their match counterparts in the 300-500 milliseconds interval. Closer inspection revealed longer-lived effects for Augmentative compared to Associative Mismatch (relative to their corresponding Match conditions). In subsequent windows, a broadly distributed late positive effect emerged for Associative Mismatch sentences relative to Associative Match between 500-700 and 700-900 milliseconds, which we qualified as a P600 effect (Figure 1, 3 and 4). In contrast, no late positive effect emerged for Augmentative Mismatch (relative to Augmentative Match), as shown in Figure 2, 3 and 4. Note that no statistically reliable effect emerged either between 100 and 300 milliseconds or after 900 milliseconds.

[Insert Figure 1 about here]

[Insert Figure 2 about here]

300-500 msec interval. In this temporal window, global ANOVA revealed a main effect of Agreement ($F_{(1,32)}$=12.49, p<.0001), a Region x Agreement interaction ($F_{(4.128)}$=6.76, p<.001) and a Region x Subject interaction ($F_{(4,128)}$=11.12, p<.001). A three-way Region x Subject x Agreement interaction ($F_{(4,128)}$= 4.89, p<.02) emerged that was disentangled with further ANOVAs for each level of the Region factor. A main effect of Subject emerged in Frontal sites ($F_{(1,32)}$=5.16, p<.01). Fronto-Central and Central sites revealed a main effect of Agreement (Fronto-Central: $F_{(1,32)}$=4.45, p<.01; Central: $F_{(1,32)}$= 13.73, p<.0001), while Centro-parietal and Parietal regions evidenced a Subject x Agreement interaction (Centro-Parietal: $F_{(1,32)}$=5.20, p<.001; Parietal: $F_{(1,32)}$= 9.92, p<.01). Pairwise comparison showed that the effect of Augmentative Mismatch was more negative compared to its Match counterpart in both regions, while the negative effect elicited by Associative Mismatch could not be distinguished by Associative Match (*Centro-Parietal*: Augmentative Mismatch

vs. Match: $t_{(32)}$=-2.92, p<.001; Associative Mismatch vs. Match: $t_{(32)}$= -0.52, p<.3; Augmentative Mismatch vs. Associative Mismatch: $t_{(32)}$=-1.05, p<.1; Associative Match vs. Augmentative Match: $t_{(32)}$=-0.05, p<.4; *Parietal*: Augmentative Mismatch vs. Match: $t_{(32)}$=-3.94, p<. 001; Associative Mismatch vs. Match: $t_{(32)}$= -0.19, p<.4; Augmentative Mismatch vs. Associative Mismatch: $t_{(32)}$= -1.66, p<.1; Associative Match vs. Augmentative Match: $t_{(32)}$= -0.10, p<.4).

Midline electrode analysis revealed a main effect of Agreement ($F_{(1,32)}$=7.45, p<.001), as well as a Subject x FCP ($F_{(2,64)}$=7.83, p<.001) and an Agreement x FCP ($F_{(2,64)}$=6.64, p<.001) interaction. Finally, a three-way interaction also emerged among the Subject, Agreement and FCP factors ($F_{(2,64)}$=7.69, p<.001). Separate ANOVAs for each level of the factor FCP revealed a main effect of Agreement in Cz ($F_{(1,32)}$=7.54, p<.001), and a Subject x Agreement interaction in Pz ($F_{(1,32)}$=5.51, p<.01).

Closer visual inspection revealed a longer-lasting negative wave for Augmentative Mismatch (relative to Augmentative Match) compared to Associative Mismatch (relative to Associative Match). Therefore, to assess whether the negative effect associated with the two mismatching patterns had a different time course, the early negativity interval was further decomposed into two windows of 100 milliseconds each (300-400 and 400-500).

300-400 msec interval. In this time interval, ERPs for the two mismatching conditions showed a distributed negativity, with the effect reaching its maximum in centro-posterior areas of the scalp bilaterally. Global ANOVA in this time interval revealed a main effect of Agreement [$F_{(1,32)}$=40.34, p<.001], a Region x Subject interaction [$F_{(4,128)}$=8.97, p<.001], and a Region x Agreement interaction [$F_{(4,128)}$=7.89, p<.001]. A three-way Region x Subject x Agreement interaction [$F_{(4,128)}$= 6.47, p<.001] was also found, which was disentangled by means of separate ANOVAs for each level of the Region factor. This analysis revealed an Agreement effect in Frontal [$F_{(1,32)}$=15.69, p<.001], Fronto-Central

[$F_{(1,32)}$=26.22, p<.001], Central [$F_{(1,32)}$=42.78, p<.001] and Centro-Parietal [$F_{(1,32)}$=49.27, p<.001] sites. In parietal regions, a Subject x Agreement interaction emerged that was qualified by a marginal difference between Associative Mismatch and Augmentative Mismatch [$t_{(32)=}$1.47, p<.07], due to the more negative effect of Augmentative Mismatch.

The analysis of midline electrode sites revealed a main effect of Agreement [$F_{(1,32)}$=32.78, p<.001]. A Subject x FCP [$F_{(1,32)}$=5.86, p<.001] interaction emerged driven by the marginally less negative effect of Associative compared to Augmentative subjects in Pz [$F_{(1,32)}$=2.97, p<.09]. An Agreement x FCP [$F_{(1,32)}$=5.52, p<.001] interaction was found, which was qualified by the more negative effect of mismatching verbs compared to matching verbs in Fz [$F_{(1,32)}$=13.16, p<.001], Cz [$F_{(1,32)}$=34.62, p<.001] and Pz [$F_{(1,32)}$=36.86, p<.001].

400-500 msec interval. In this time interval, the two mismatching conditions (relative to their correct counterparts) elicited qualitatively different effects: while Augmentative Mismatch showed a sizeable negative effect, a more positive effect was generated by Associative Mismatch. This asymmetry was confirmed by a Subject x Agreement interaction [$F_{(1,32)}$=4.89, p<01]. While Augmentative Mismatch differed from Augmentative Match ($t_{(32)}$=-1.92, p<.05), the effect of Associative Mismatch relative to Associative Match was only marginally significant ($t_{(32)}$=-1.42, p=.08). Moreover, Augmentative Match and Associative Match [$t_{(32)}$=-1.92, p<.05] also differed. The greater negative effect of Augmentative Mismatch compared to Augmentative Match and Associative Mismatch was further confirmed by a marginal three-way Region x Subject x Agreement interaction [$F_{(4,128)}$=2.81, p<.09], which revealed the more negative effect in Parietal sites of Augmentative Mismatch sentences compared to Augmentative Match [$t_{(32)}$=-1.72, p<.05] and Associative Mismatch [$t_{(32)}$=-1.73, p<.0.5], while no difference emerged either from the

comparison between Augmentative-Mismatch and Augmentative-Match [$t_{(32)}$=0.17, p>.1] or between Augmentative Match and Associative Match [t(32)=0.07, p<.5].

The analysis of midline electrode sites revealed a Subject x FCP [$F_{(1,32)}$=8.05, p<.001] , an Agreement x FCP [$F_{(1,32)}$=6.46, p<.001], and a Subject x Agreement x FCP interaction [$F_{(2,64)}$=6.84, p<.001]. Separate ANOVA on each level of the FCP factor revealed a marginal difference between Augmentative Mismatch and Associative Mismatch in Cz [$t_{(32)}$=-1.72, p<.06].

Overall, the analysis of the ERP for mismatching vs. matching conditions between 300 and 500 milliseconds shows a remarkable asymmetry between Augmentative- and Associative-subject sentences. The distribution of Associative Mismatch negativity is consistent with the N400 effect for semantic violations (typically evident at all scalp sites and with a centro-parietal maximum, see Kutas & Federmeier 2011 for a review), while its early and short-lasting latency (between 300 and 400 milliseconds) are not. For this reason, we will refer to this effect as N400-like. In contrast, both the broad distribution and latency for Augmentative Mismatch (relative to Augmentative Match) allow us to label this negative effect as an N400 effect.

500-700 msec interval. In this time interval, Associative Mismatch elicits a distributed positive effect relative to Associative Match, while the effect of Augmentative Mismatch cannot be distinguished from Augmentative Match. This difference is confirmed by an interaction between Subject and Agreement [$F_{(1,32)}$=12.47, p<001] that revealed the presence of a more positive effect for Associative Mismatch relative to Associative Match [$t_{(32)}$=13.38, p<.001], and for Augmentative Match relative to Associative Match [$t_{(32)}$=-4.64, p<.001]. The comparison between Augmentative Mismatch and Augmentative Match, showed no reliable difference ($t_{(32)}$=-0.02, p>.1). An interaction Region x Agreement

[$F_{(4,128)}$=4.13, p<001] was also found due to the more positive effect of Mismatch relative to Match conditions in Fronto-Central [$F_{(1,32)}$=6.46, p<001], Central [$F_{(1,32)}$=12.93, p<001], Centro-Parietal [$F_{(1,32)}$=13.40, p<001] and Parietal regions [$F_{(1,32)}$=16.71, p<001].

Analysis of midline electrodes revealed a main effect of Agreement [$F_{(1,32)}$=10.85, p<.001], as well as a Subject by Agreement interaction [$F_{(1,32)}$=10.07, p<.001] and a three-way Subject x Agreement x FCP interaction [$F_{(2,64)}$ =7.25, p<.01]. Separate ANOVAs were run on each level of the FCP factor and revealed a main effect of Agreement [$F_{(1,32)}$=10.37, p<.001] and an interaction Subject x Agreement [$F_{(1,32)}$=18.96, p<.001] in Cz, driven by the positive effect for Associative Mismatch (relative to Associative Match, $t_{(32)}$=-2.70, p<.01). In Pz, a main effect of Subject [$F_{(1,32)}$=6.22, p<.01] and of Agreement [$F_{(1,32)}$=12.62, p<.001] emerged, as well as a Subject x Agreement interaction [$F_{(1,32)}$=15.40, p<.001] qualified by a significant difference between Associative Mismatch and Associative Match [t(32)=-2.75, p<.01]. No difference was found between Augmentative Mismatch and Match.

700-900 msec interval. In this time window, only Associative Mismatch elicited a distributed positive effect relative to Associative Match, while the effect of Augmentative Mismatch could not be distinguished from Augmentative Match. Global ANOVA revealed a Region x Subject [$F_{(4,128)}$=9.90, p<.001] interaction, driven by the more positive effect of Associative subjects in Parietal sites [$F_{(1,32)}$=8.50, p<.001]. Moreover, a main effect of Agreement [$F_{(1,32)}$=9.57, p<.001], a Region x Agreement [$F_{(4,128)}$=4.19, p<.01] and a Region x Hemisphere x Agreement interaction [$F_{(4,128)}$=3.06, p<.01] were found. Separate ANOVAs for each level of the Region and Hemisphere factors were run, which showed that the broadly distributed positive effect of mismatching conditions (relative to matching ones) reached its maximum in centro-parietal and parietal sites [Right Frontal: $F_{(1,32)}$=3.30, p<.07; Left Frontal: $F_{(1,32)}$=0.05, p>1; Right Fronto-Central: $F_{(1,32)}$=6.48, p<.01, Left Fronto-

Central: $F_{(1,32)}$=2.08, p=.1; Right Central: $F_{(1,32)}$=9.52, p<.001; Left Central: $F_{(1,32)}$=8.21, p<.001; Right Centro-Parietal: $F_{(1,32)}$=15.36, p<.001; Left Centro-Parietal: $F_{(1,32)}$=18.54, p<.001; Right Parietal: $F_{(1,32)}$=16.60, p<.001; Left Centro-Parietal; $F_{(1,32)}$=17.42, p<.001]. The presence of a Subject x Agreement interaction [$F_{(1,32)}$=7.58, p<.001] evidenced that the more positive effect of mismatching conditions was mainly due to the difference between Associative Mismatch relative to Associative Match [$t_{(32)}$=-6.69, p<.001] and Augmentative Mismatch [$t_{(32)}$=-2.59, p<.05], and between the two match conditions [t(32)=-2.16, p<.01]. No difference emerged from the comparison between Augmentative Mismatch and Augmentative Match [$t_{(32)}$=-0.5, p>1].

[Insert Figure 3 about here]

[Insert Figure 4 about here]

DISCUSSION

The current paper set out to explore the comprehension of associative and augmentative person agreement in Basque, to assess the relative contribution of nominal and verbal morphology and the role played by their relative semantic markedness. We hypothesized that the parser would be sensitive to the position of marked person values and that this would shape the processing routines underlying the comprehension of subject-verb agreement. Particularly, violations could be better tolerated when the agreement controller could be re-interpreted based on more marked person specifications available on the target (as in 5b, Japoniarr**ek**$_{3.pl}$ euskara ikasi ***dugu**$_{1.pl}$, The Japanese$_{3.pl}$ have$_{1.pl}$ learnt Basque with pleasure), compared to when the inflection on the target could not supply a more specific person value (as in 4b, Japoniarr**ok**$_{1.pl}$ euskara ikasi ***dute**$_{3.pl}$, We Japanese$_{1.pl}$ have$_{3.pl}$ learnt Basque with pleasure). In line with our predictions, the analysis of the two types of person mismatch evidenced qualitatively different ERP patterns and different time courses (Figure 4). Associative person mismatches elicited an early and

short-lasting negative effect, followed by a sizeable P600 effect that extended from 500 to 900 milliseconds. In contrast, augmentative person mismatches revealed a longer-lasting negativity but no P600 effect. In the following, we discuss these findings and their implications from a processing and theoretical perspective.

The flexibility of agreement processing routines

The biphasic ERP effect that emerged for associative person anomalies is in line with previous findings on person agreement in Spanish (Mancini et al. 2011a; 2011b; but see Silva-Pereyra & Carreiras for anterior negative effects) and Basque (Zawiszewski & Friederici, 2009; Zawiszewski et al. 2016). In this respect, violations involving associative person values on the subject seem to behave similarly to singular person anomalies. Mancini and colleagues (Mancini et al. 2011a; 2011b) interpreted N400 effects to person agreement violations in Spanish as processing reflexes of the incompatibility of subject's and verb's person values, when two distinct and mutually exclusive discourse roles are invoked for the same entity, namely a non-participant and an addressee. Similarly, the N400 reported here for person mismatches with associative subjects plausibly reflects the incompatibility of a non-participant reading for ok-marked subjects.

However, on a closer inspection, the negative effect reported in this study shows a notably shorter latency compared to the early negativity reported in other studies on Basque person agreement processing (Zawiszewski & Friederici, 2009; Zawisewski et al. 2016), where the effect extended from 300 to 500 milliseconds. Zawiszewski and Friederici (2009) and Zawisewski and colleagues (2016) manipulated object- and subject-verb person agreement using 2nd person singular pronouns (*zuk*, you$_{sg}$), while we resorted to referential NPs (*japoniarrek/japoniarrok*). The use of different agreement controllers could therefore explain this difference. The morphologically and semantically more marked

person information provided by the proximate plural determiner –ok that was used in this study could have also contributed to determining the different timing of our early negative effect compared to previous investigations.

After the detection of a mismatch, a conflict-monitoring response is generated which is visible from as early as 400 milliseconds after verb presentation and that reaches its maximum between 500 and 700 milliseconds (Figure 4). Assuming that the P600 reflects the detection of a conflict between two representations (Van den Meerendonk et al. 2009), the emergence of this response clearly indicates that the contrast between the expected and the perceived stimulus in terms of morphosyntactic and discourse representation is strong enough as to activate the monitoring system and start repair processes.

While the processing of an unmarked verb after a marked subject appears to represent a strong violation of expectancy that is quickly detected by checking and conflict-monitoring mechanisms, a different scenario emerges when marked person information is carried by the verb. Indeed, in spite of the very similar negative effect that associative and augmentative person mismatches elicit between 300 and 400 milliseconds, the processing routines that characterize later stages appear to be significantly shaped by the feature makeup of subjects and verbs. The monophasic negative response that augmentative mismatch elicit compared to associative ones suggests that the incongruence is not strong enough to alert the conflict-monitoring system and trigger the performance of reanalysis mechanisms. This result is thus in line with our hypothesis about the adoption of a more specific reading for unmarked plural subject when followed by a marked verb. Based on this, we would like to propose that the processing routines that guide person agreement analysis are flexible enough to tolerate a mismatch under certain circumstances, i.e. the presence of an unmarked subject. This flexibility emerges relatively early, namely in the temporal interval where the N400 effect arises. The different time course that

characterizes the early negative effects for augmentative and associative person agreement allows us to identify the performance of mapping operations between 400 and 500 milliseconds, right after the detection of a morphosyntactic mismatch. In this short time window, mapping between morphosyntax and discourse occurs if the mismatch previously detected is compatible with an alternative reading of the subject. When this is not the case, the conflict-monitoring system is alerted and repair operations start. Support for this interpretation comes also from recent eye-tracking data (Mancini et al. 2014), which revealed a temporal dissociation between the analysis of morphosyntactic consistency and the assignment of the overall 1st person plural interpretation in Spanish unagreement. Specifically, by contrasting discourse-plausible and implausible unagreement patterns, the authors showed that early reading stages were mainly sensitive to the presence of a morphosyntactic mismatch between subject-verb agreement, regardless of the discourse plausibility of the relation. In contrast, whether the subject could plausibly receive a 1st person interpretation (as in "*Los pajaros volamos en el cielo*", we birds flew in the sky) mostly affected later reading measures.

It should be noticed that our results are not in line with previous studies on the role of morphological markedness in agreement comprehension (Alemán Bañon & Rothman, 2016). In their study, Alemán Bañon and Rothman (2016) found that when the anomalous word was marked, a larger and earlier P600 effect emerged. On the contrary, in this study, a more marked mismatching verb (*dugu*) did not generate any P600 effect. Two factors could have significantly contributed to this difference, namely the focus on semantic rather than morphological markedness, and the manipulation of person rather than number agreement.

Augmentative person mismatches and Spanish unagreement

Worthy of discussion is the fact that the monophasic pattern associated with augmentative agreement strongly recalls the findings from Mancini et al. (2011b) for the processing of unagreement. The parallelism between the two studies is even more striking if we consider that the augmentative mismatch conditions used here present the same person marking contrast as in the unagreement manipulation used by Mancini et al. (2011), as illustrated in 1a. One could therefore argue that the construction tested here represents the Basque manifestation of unagreement. Indeed, Torrego & Laka (2015) propose that Basque, similarly to Spanish, allows for unagreement patterns, of which augmentative mismatch in 5b would be an example (Japoniarr**ek**$_{3.pl}$ …. ***dugu**$_{1.pl}$, The Japanese$_{3.pl}$…. have$_{1.pl}$). Straightforward as this parallelism between Spanish and Basque may be, two fundamental differences must be highlighted. Firstly, while the acceptability of the Basque patterns appears to be subject to individual variability, as shown by the lower accuracy in the online and offline behavioral tasks reported here, Spanish unagreement acceptability is not (see Mancini et al. 2011b). In this respect, one possible explanation behind the asymmetry between the two languages could reside in the fact that mismatches of this kind are not typically attested in the standard variant of Basque tested in this study. To the best of our knowledge, the use of 3rd person plural subjects followed by 1st person verbs is not reported either in descriptive (Hualde & Ortiz de Urbina, 200; de Rijk, 2008; Laka, 1996) or more pedagogical grammars (King, 1994) of Basque, suggesting a non-standard (and perhaps geographically limited) usage of this pattern. From this perspective, when speakers are asked to explicitly judge these patterns (both offline and at the end of each sentence in the ERP experiment), they may find themselves uncertain as to whether a standard, normative criterion should be used to evaluate them, hence the significantly different behavioral performance on Augmentative Mismatch compared to the other conditions.

Under this hypothesis, it is therefore possible that individual differences in the evaluation of the acceptability of a sentence may predict individual differences in ERP effects, which grand-averaging procedures potentially obscure. If this is so, one should expect accuracy to be a strong predictor of ERP correlates, and especially of late positive effects: the more speakers evaluate Augmentative Mismatch as incorrect, the greater the probability that a P600 effect emerges. To explore this hypothesis, we calculated the magnitude of the ERP effect in the 500-700 millisecond window (difference between mismatch and match trials, for both Associative and Augmentative subjects, across all electrodes), as well as the difference between mismatch and match trials in the percentage of accurate responses (for both associative and augmentative subjects conditions). A multiple regression analysis was performed with ERP effect size as dependent variable, and Subject and Accuracy size as predictors. As expected, the analysis revealed a greater ERP effect size for associative compared to augmentative subjects (reference level: associative subjects, Intercept: 1.46, Estimate: -1.47, SE: 0.53, t=-2.72). However, this difference was not influenced by the degree of accuracy with which mismatching sentences were judged, as evidenced by the lack of interaction between Subject and Accuracy [reference level: associative subjects, Intercept: 1.46, Estimate: -0.39, SE: 0.75, t=-0.52]. What this analysis suggests is that ERPs at auxiliary verb position and acceptability judgment arguably capture two different aspects of sentential processing. While the former dependent variable captures online effects of morphosyntactic and discourse compatibility between the verb and the immediately preceding sentential context, the latter reflects a meta-linguistic process that takes into account the whole sentence and therefore linguistic aspects that are likely to be unavailable when the verb is parsed.

Secondly, the negative effect elicited by Basque augmentative mismatch sentences is shorter-lasting and has a different topographical distribution compared to Spanish unagreement negativity: while the former is circumscribed within 300 and 500 milliseconds

and has a prevalently posterior distribution, the latter extends to the 500-700 msec interval and has a more central distribution. Although the two studies differ in a number of factors (from the language tested and linguistic profile of the participants, to the grammaticality status of the critical material), another possible explanation for this cross-linguistic difference concerns the difference between auxiliary and lexical verbs. While the unagreement effect is measured on a lexical verb in Spanish, an auxiliary verb is involved in Basque. Both types of verbs carry inflectional morphology, but only the former has also lexico-semantic information, which may determine longer and costlier processing routines. However, this hypothesis should be corroborated by further research in which a systematic manipulation of person agreement in lexical and auxiliary verbs is carried out.

To further investigate the relation between Spanish unagreement and Basque augmentative person mismatches, we also examined the bilingual profile of our participant sample, to assess the impact of individual daily usage of Spanish on ERP correlates. Usage is here operationalized as the percentage of reading, speaking, listening and writing activity performed in a language on a daily basis. Specifically, we hypothesized that the greater the usage of Spanish, the more likely it is that speakers extend unagreement usage to Basque, and thus the less likely it is that a P600 emerges. A multiple regression model was built with ERP size as the dependent variable, and Subject and Average Usage of Spanish as predictors. The analysis confirmed the greater ERP effect size for associative compared to augmentative subjects [Reference level: associative, Intercept: 1.72, Estimate: -1.86, SE: 0.50, t= -3.80]. However, this difference was not modulated by the degree of Spanish usage among participants [Reference level: associative, Intercept: 1.72, Estimate: -0.05, SE: 0.49, t= -0.1].

Undoubtedly, further theoretical research should be aimed at better assessing the relation between Spanish unagreement and Basque augmentative person mismatches from a

syntactic perspective. Nevertheless, the processing similarities between Spanish and Basque mismatches that we report here are highly suggestive of the cross-linguistic validity of our prediction concerning the flexibility of the parser when dealing with augmentative person mismatches.

CONCLUSION

By investigating fine-grained aspects of person agreement processing, the current study has added yet another important piece to the study of online sentence processing. Critically, the results reported here add on both theoretical and processing perspectives on agreement processing.

From a theoretical standpoint, the current set of data, together with the findings discussed by Mancini et al. (2011), is compatible with theoretical views that propose the independence of verbal and nominal features (Ackema & Neeleman, 2013; Mancini, 2018; Mancini et al. 2011, 2013). Here we take feature independence to mean that subject and verb do not display the same person values, and we note that it does not necessarily imply a symmetric view of agreement computation. As the overall interpretation of augmentative mismatch relation relies on the overwriting (Mancini, 2018; Mancini et al. 2011b, 2013) or spreading (Ackema & Neeleman, 2013) of verbal 1st person onto nominal 3rd person values, an inherent asymmetry can be therefore maintained.

Finally, from a processing perspective, we have shown that the linguistic brain is flexible enough to tolerate deviations from standardly accepted patterns. Importantly, such flexibility manifests itself early during online processing of verbal morpphology and appears to be part of a cognitive mechanism that operates across typologically different languages and regardless of the grammaticality of the agreement pattern. Future research

will be however needed to determine the generalizability of this processing flexibility to further features, languages and syntactic structures.

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Figure Captions

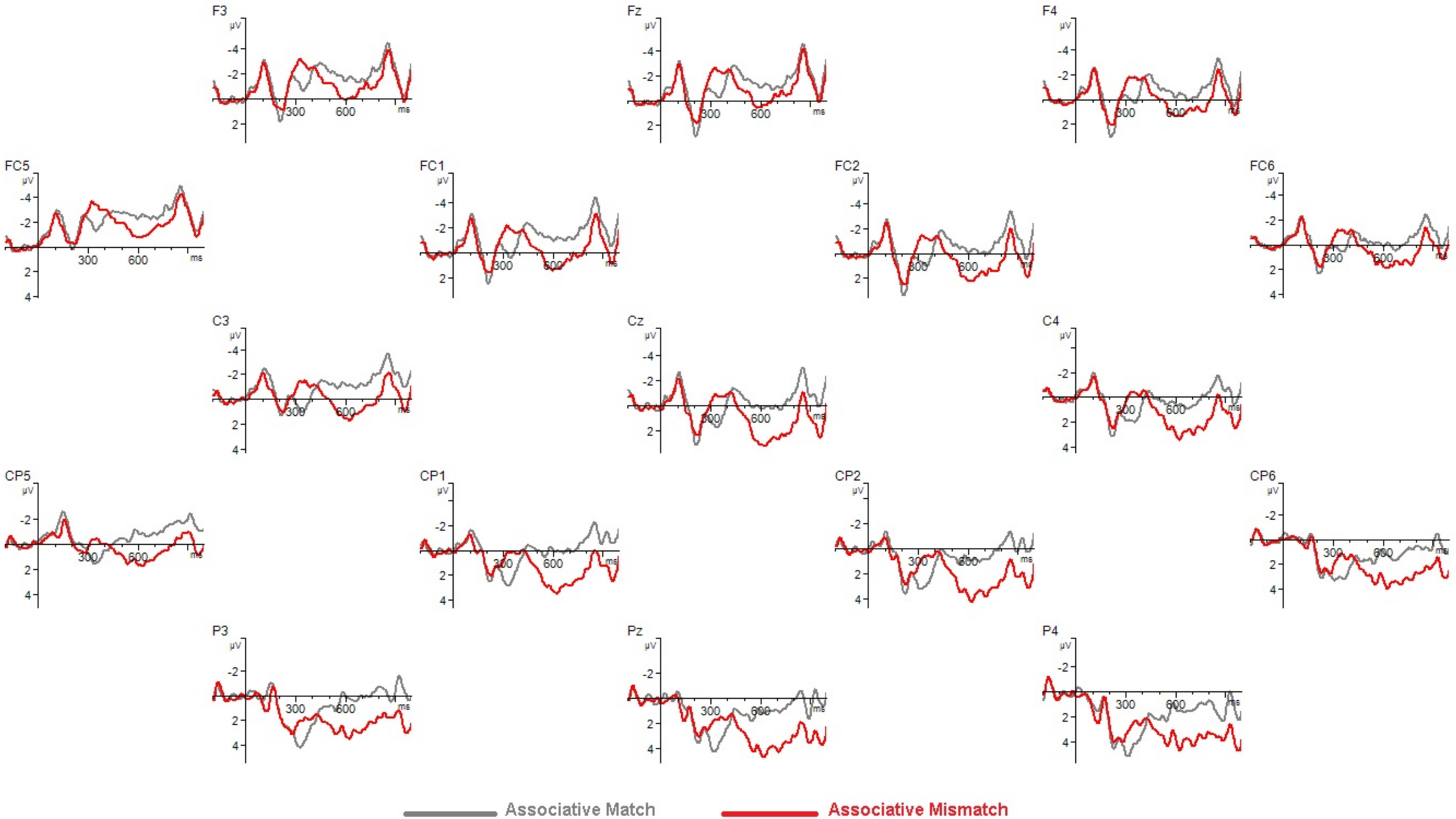
Figure 1. Grand-averaged ERPs time-locked to the verb presentation for the Associative Match (grey line) compared to the Associative Mismatch (red line) condition.

Figure 2. Grand-averaged ERPs time-locked to the verb presentation for the Augmentative Match (grey line) compared to the Augmentative Mismatch (red line) condition.

Figure 3. Difference waves comparing Associative Mismatch minus Associative Match (red line) and Augmentative Mismatch minus Augmentative Match (grey line)

Figure 4. Topographical maps for the four conditions. Map values are calculated as the average mean amplitude value for each mismatching condition relative to its match condition.

Figure1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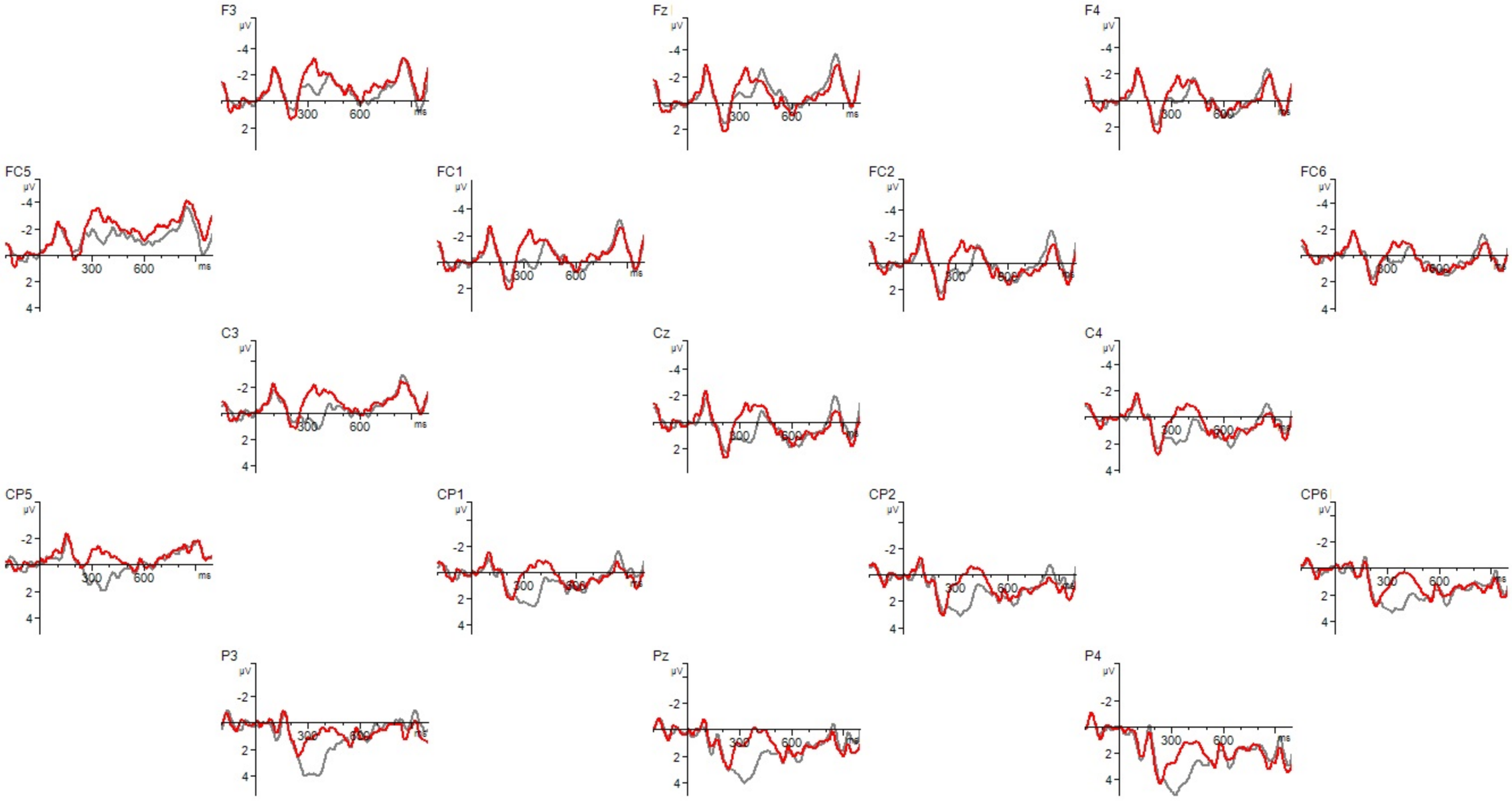
Associative Match
Associative Mismatch

Figure2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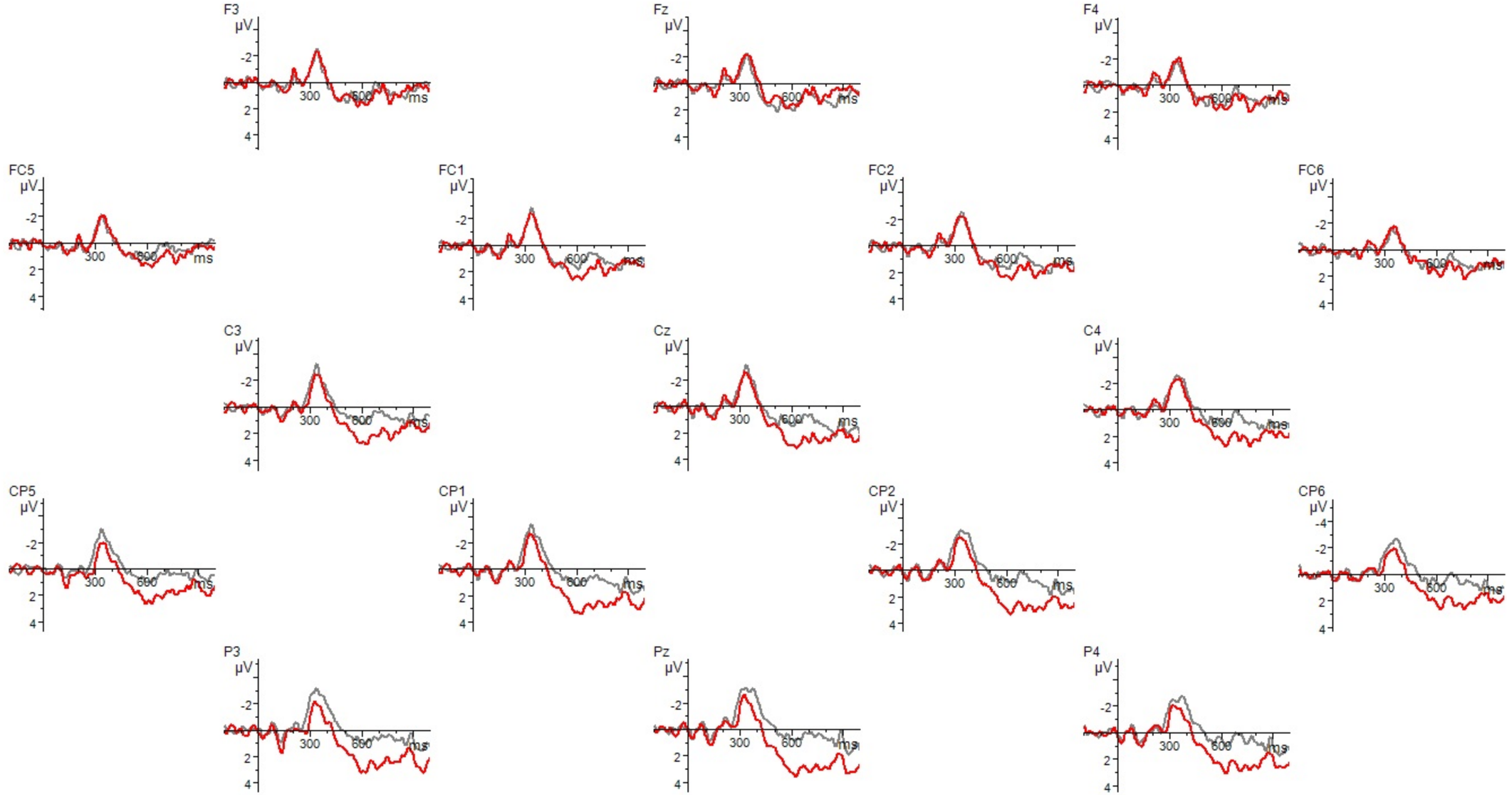
Augmentative Match
Augmentative Mismatch

Figure3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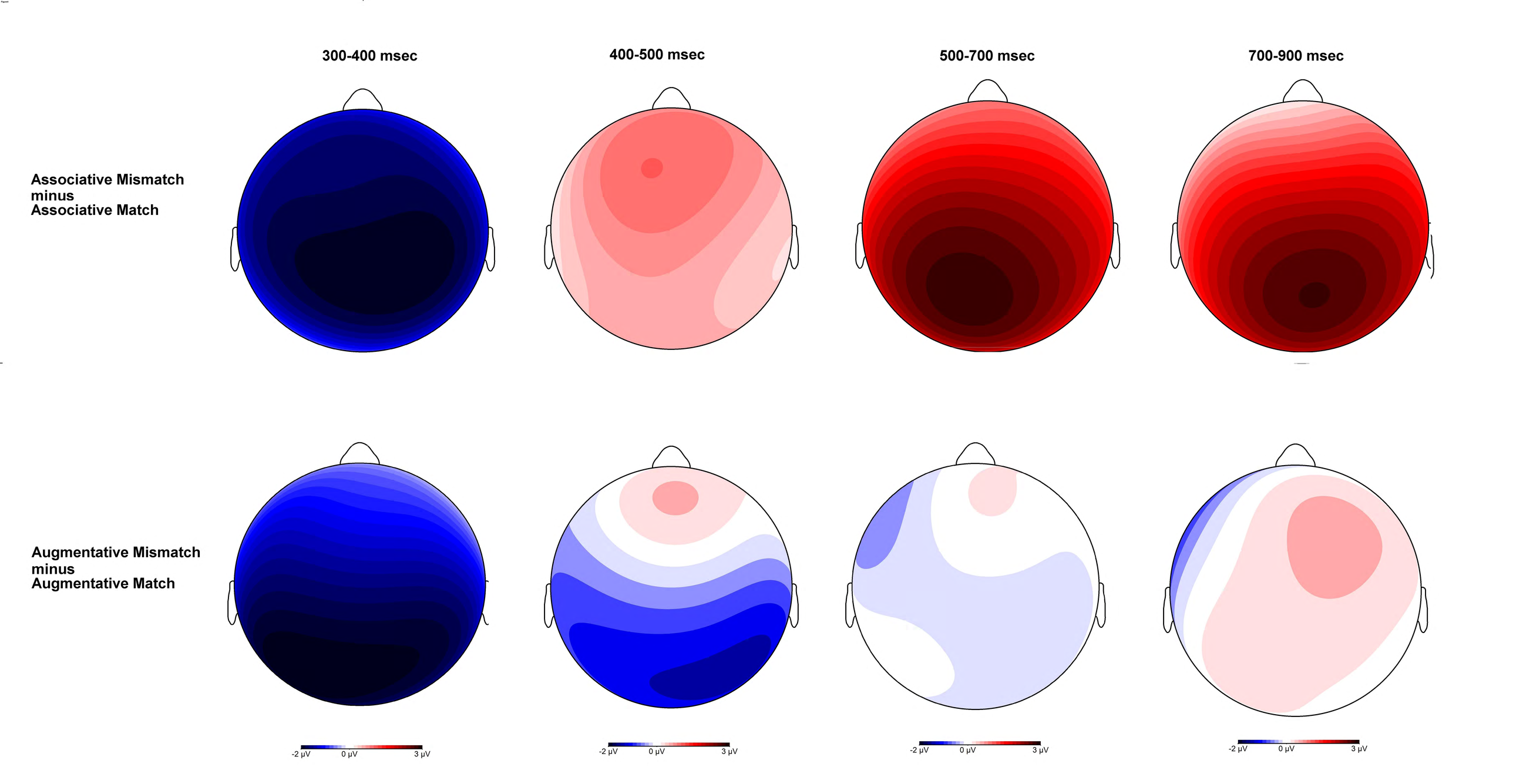
Augmentative Mismatch-Match
Associative Mismatch-Match


300-400 msec
400-500 msec
500-700 msec
700-900 msec
Associative Mismatch
minus
Associative Match
Augmentative Mismatch
minus
Augmentative Match
-2 µV
0 µV
3 µV