

Article

Correlative Coordination and Variable Subject–Verb Agreement in German

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Abstract: Coordinated subjects often show variable number agreement with the finite verb, but linguistic approaches to this phenomenon have rarely been informed by systematically collected data. We report the results from three experiments investigating German speakers' agreement preferences with complex subjects joined by the correlative conjunctions *sowohl ... als auch* ('both ... and'), *weder ... noch* ('neither ... nor') or *entweder ... oder* ('either ... or'). We examine to what extent conjunction type and a conjunct's relative proximity to the verb affect the acceptability and processability of singular vs. plural agreement. Experiment 1 was an untimed acceptability rating task, Experiment 2 a timed sentence completion task, and Experiment 3 was a self-paced reading task. Taken together, our results show that number agreement with correlative coordination in German is primarily determined by a default constraint triggering plural agreement, which interacts with linear order and semantic factors. Semantic differences between conjunctions only affected speakers' agreement preferences in the absence of processing pressure but not their initial agreement computation. The combined results from our offline and online experimental measures of German speakers' agreement preferences suggest that the constraints under investigation do not only differ in their relative weighting but also in their relative timing during agreement computation.



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1. Introduction

Complex subjects joined by correlative conjunctions such as German *sowohl ... als auch* ('both ... and'), *weder ... noch* ('neither ... nor') or *entweder ... oder* ('either ... or') may allow for variable number agreement with the verb, as is illustrated by the examples in (1a–c) below (adapted from Wegerer 2012).

- (1) a. *Sowohl* *das Buch* *als* *auch* *der Film* {*wird/werden*}
both the book as also the film is/are
morgen veröffentlicht.
tomorrow published
'Both the book and the film will be published tomorrow.'
- b. *Weder* *Reue* *noch* *Schuldgefühl* {*peinigt/peinigen*} *seine Seele.*
neither regret nor guilt torments/torment his soul
'Neither regret nor guilt torment(s) his soul.'
- c. *Entweder* *der Steuermann* *oder* *der Kapitän*
either the helmsman or the captain
{*bestimmt/bestimmen*} *den Kurs.*
determines/determine the route
'Either the helmsman or the captain determine(s) the route.'

There has been much debate among prescriptive and descriptive grammarians as to whether singular or plural agreement is grammatically appropriate in such cases (see Jaeger 1992 and Wegerer 2012 for comprehensive reviews and discussion). Wustmann (1903), for example, states that singular noun phrases conjoined by 'juxtaposing' conjunctions such as *sowohl ... als auch* or *weder ... noch* should always be used with singular verbs. Eisenberg (1989), on the other hand, considers plural agreement the appropriate choice

in cases like (1a) and singular agreement to be appropriate in (1b). The Hennig (2016) *Duden* reference grammar considers both singular and plural agreement to be possible for additive conjunctions as in (1a,b). The conjuncts' semantic properties are also likely to play a role in determining number agreement with correlatively conjoined subjects. Findreng (1971), for example, notes that the extent to which singular subjects conjoined by *weder ... noch* allow for plural agreement may depend on how difficult it is to construe the two conjuncts as a single unit. Regarding the disjunctive conjunction *entweder ... oder* in (1c), there appears to be some consensus that singular verbs should be preferred (e.g., Hennig 2016; Eisenberg 1989; Jaeger 1992; Findreng 1971).

Few previous studies have tried to quantify German speakers' verb number preferences for sentences containing complex subjects joined by correlative conjunctions, however. Wegerer (2012) carried out a questionnaire study examining a wide range of number agreement conflicts in German. Her stimulus materials also included one or two tokens each of the conjunctions in (1a–c). She found that for *sowohl ... als auch* coordination in sentence (1a), plural verbs were chosen over singular ones by 85% of her participants. *Weder ... noch* in sentence (1b) elicited a weaker plural preference of 64%. For sentence (1c) containing disjunctive *entweder ... oder*, plural verbs were chosen by nearly half of her participants (45%), a higher proportion than might be expected. Given the small number of experimental tokens in Wegerer's study, and the fact that her materials were not created in a systematic fashion in a minimal-pair design, it is not clear whether her findings, including the observed differences between individual conjunctions, generalize beyond the individual examples that she tested.

The situation may become more complicated if the two conjuncts carry conflicting number features. Both Eisenberg (1989) and Hennig (2016) observe that a plural verb is usually chosen if one of the conjuncts appears in the plural. It has also been suggested that verbal agreement tends to be determined by the conjunct closest to the verb, however (e.g., Klein 2004). This phenomenon is commonly referred to as 'closest conjunct agreement' (Nevins 2019), which has been argued to be different from the more widely studied phenomenon of agreement attraction errors (Keung and Staub 2018). To our knowledge, German speakers' agreement preferences for number conflict cases in correlative coordination have never been systematically examined in experimental settings.

Here we report three experiments designed to assess German speakers' number agreement preferences with subjects joined by correlative conjunctions. Experiments 1 and 2 use acceptability judgement and timed sentence completion tasks to investigate the two additive conjunctions *sowohl ... als auch* and *weder ... noch*, and Experiment 3 uses a self-paced reading acceptability judgement task to examine effects of conjunct proximity on German speakers' verb number preferences for additive *sowohl ... als auch* and disjunctive *entweder ... oder*. Our study addresses the following empirical questions:

- How does the semantic type of conjunction affect the acceptability and processability of singular vs. plural agreement?
- How does a conjunct's linear proximity to the verb affect speakers' agreement preferences in number conflict cases?
- How do conjunction type and conjunct proximity interact in the computation of agreement?

Our multi-experimental approach furthermore allows us to establish whether speakers' agreement preferences remain consistent across different types of linguistic task. Following a brief review of theoretical and experimental approaches to correlative coordination, we present each of our three experiments in turn. We then discuss our results in the light of previous descriptive claims about agreement with correlatively conjoined subjects and consider the theoretical implications of our findings.

2. Theoretical and Experimental Approaches to Correlative Coordination

Several different proposals have been made in the theoretical literature regarding the structure of correlative coordination and the internal make-up of correlative conjunctions.

The first element of a correlative conjunction has been argued to function as a focus particle (Hendriks 2004) that is either base-generated in a head position (e.g., Zhang 2008) or adjoined to a conjunction phrase (ConjP) (Johannessen 2005) as shown in (2) below.

- (2) ... dass [ConjP sowohl [ConjP [DP der Bruder] [ConjP' [Conj als auch]
 ... that both the brother as also
 [DP die Schwester]]] gesund sind
 the sister healthy are
 '... that both the brother and the sister are healthy.'

In example (2), the two conjoined noun phrases occupy the specifier and complement position within ConjP, respectively, and the conjunction phrase is assumed to carry a plural specification or *and*-feature (Johannessen 2005, p. 421). Johannessen argues that correlatives select a matching conjunction phrase, with English *both*, for example, requiring a ConjP whose head carries a plural feature.

An alternative analysis to (2) has been proposed by Schwarz (1999) according to which correlative coordination involves an elliptical construction derived from the conjunction of two separate clauses, as indicated in (3).

- (3) ... dass sowohl [IP der Bruder gesund ist]. als auch
 ... that both the brother healthy is and also
 [IP die Schwester gesund ist].
 the sister healthy is

Other approaches to number agreement with coordinated subjects include the proposal that the conjoined noun phrase's number specification interacts with semantic information (such as the subject phrase's notional plurality) to favour either singular or plural agreement (Lorimor et al. 2018). A comprehensive review of theoretical approaches to agreement with coordinated subjects is beyond our study's scope, but it is conceivable that alternative syntactic or semantic representations of correlative coordination are available to speakers of German in principle. If this is the case, then one way of accounting for the observed variation in number agreement formally would be to assume that the conjoined phrase is structurally ambiguous. For subjects containing conjoined singular noun phrases, we would expect the analysis in (2) to trigger plural agreement and the analysis in (3) to trigger singular agreement. If one of the conjoined noun phrases carries a plural feature, the analysis in (2) would again give rise to plural agreement, whilst according to the ellipsis analysis in (3), verb number should be determined by the second conjunct's number feature.

Regardless of how variable agreement with coordinated subject may best be accounted for formally, the potential availability of alternative representations does not by itself tell us anything as to which analysis is preferred, or under what circumstances it is preferred. Evidence from sentence processing studies shows that in cases of temporary structural ambiguity, noun phrase coordination is preferred over sentential coordination (Engelhardt and Ferreira 2010; Frazier 1987; Hoeks et al. 2002), and noun phrase coordination has also been found to be more frequent in corpora (e.g., Desmet and Gibson 2003). Both from a computational economy and from a usage-based perspective we might thus expect an analysis along the lines of (2) to be preferred, other things being equal.

The computation of number agreement may also be affected by differences in the semantic structure of individual conjunctions. While *sowohl ... als auch* ('both ... and') is clearly additive, *weder ... noch* ('neither ... nor') might be considered to be disjunctive (e.g., Zamparelli 2019, p. 142). Wurmbrand (2008), however, argues that *neither ... nor* is also semantically additive and differs from other additive conjunctions only in containing a negation. An unequivocal example of a disjunctive conjunction is *entweder ... oder* ('either ... or'), which normally has an exclusive reading.

Speakers' number agreement preferences with correlative coordination have rarely been examined experimentally. Peterson (1986) carried out a forced-choice sentence completion task to assess English speakers' agreement preferences for subject phrases conjoined

by disjunctive connectors. For number conflict cases as in (4) involving *either ... or*, participants' agreement choices indicated considerable uncertainty.

- (4) a. Either this tree or those shrubs {has/have} to be cut down.
- b. Either your cats or my dog {has/have} eaten all the daisies.

Peterson attributed this to the interplay of a set of potentially competing agreement 'strategies' whose relative strength might differ from speaker to speaker. These include a strategy to choose plural agreement if one of the conjuncts is plural (PLURAL WINS), a potentially conflicting strategy that favours agreement with the closest conjunct (PROXIMITY) as well as a strategy favouring agreement with the first conjunct (FIRST CONJUNCT WINS). Although for both (4a) and (4b), plural agreement was preferred, the presence of a second singular conjunct in (4b) increased the number of singular responses by more than half relative to (4a). Peterson (1986, p. 240) concluded that for subjects conjoined by *either ... or* that carry conflicting number features, the PLURAL WINS strategy is stronger than PROXIMITY, while the FIRST CONJUNCT WINS strategy is the weakest one. However, as Peterson (1986) stimulus materials only included a few tokens of the kind shown in (4), it is unclear whether his observations extend to correlative coordination more generally. Subsequent experimental studies using better controlled materials have found strong conjunct proximity effects for subjects conjoined by disjunctive *or* but did not examine correlative conjunctions (Haskell and MacDonald 2005; Keung and Staub 2018).

Disjunctively coordinated phrases might be processed differently depending on the presence or absence of an initial correlative particle. Staub and Clifton (2006) observed that for sentences such as {*Either/Ø*} *John borrowed a rake or his wife bought one*, the presence of *either* facilitated the processing of the second (sentential) conjunct. The authors suggested that *either* signals an upcoming disjunction, leading the parser to generate a conjunction phrase in anticipation and thus speeding up processing, relative to phrases or sentences conjoined by *or*. Variability in speakers' agreement choices and a stronger reliance on conjunct order for disjunctive compared with additive conjunctions (Keung and Staub 2018) would be expected if conjunction phrases headed by a disjunctive connector are unspecified for number (compare e.g., Peterson 1986, 2004; Foppolo and Staub 2020), so that verbal agreement must be determined based on other factors including linear order.

Although little systematic research has been carried out on agreement with correlatively conjoined subjects, empirical findings from studies on other types of coordination suggest that speakers' agreement preferences might best be captured by constraint-based models of grammar which allow for individual constraints to be weighted (see Jessen et al. n.d.) or by multiple-constraint models of agreement processing (e.g., Haskell and MacDonald 2003). Rather than seeking to adjudicate between individual theoretical approaches to correlative coordination, our study's primary objective was to strengthen the empirical base that informs linguistic theorizing. We consider the potential implications of our results for the computation of agreement with correlatively conjoined subjects in our General Discussion.

3. Experiment 1: Acceptability Ratings

Our first experiment used scalar acceptability ratings to gauge the extent to which German speakers consider singular and plural agreement acceptable, both with two singular conjuncts and in cases of number conflicts. Experiment 1 focused on the additive conjunction *sowohl ... als auch* ('both ... and') and its negative counterpart *weder ... noch* ('neither ... nor'), for which conflicting claims have been made regarding their compatibility with singular vs. plural agreement.

3.1. Method

3.1.1. Participants

We recruited 65 German native speakers (four male; mean age: 25.06 years, SD: 6.9, range 18–57 years) from the Potsdam and Berlin area, a part of Germany where Standard

German is the dominant native variety and means of communication. They were recruited via the University's participant database and social media posts. All participants reported to have grown up with only German being spoken at home. Fifty-three participants held a high school diploma (German *Abitur*) and were studying at university at the time of testing. Five participants had a university degree and seven had completed vocational training. All participants had normal hearing, normal or corrected to normal vision, and did not suffer from any neurological or language impairments. Prior to the experiment they gave written consent, and they received a small fee for participation after completing the experiment.

3.1.2. Materials

We created 24 sentence sets as illustrated in Table 1 below. All sentences started with a main clause of the form 'X said' or 'X believed', and coordinated subjects appeared in a finite declarative complement clause introduced by *dass* ('that'). The complement clause subject consisted of two noun phrases conjoined by *sowohl ... als auch* ('both ... and') or *weder ... noch* ('neither ... nor'). To control for possible effects of the conjuncts' semantic type (Findreng 1971), we only used noun phrases referring to people. The subject's predicate phrase contained either the third person singular auxiliary *ist* ('is') or the corresponding plural form *sind* ('are'). German embedded clauses are verb-final, which allowed us to make sure that the critical auxiliary was always the final word.

Table 1. Example stimulus set, Experiment 1 (S = singular, P = plural).

Condition		Example
<i>sowohl ... als auch</i> 'both ... and'	SPP	<i>Maria sagt, dass sowohl der Vater als auch die Söhne einkaufen gegangen sind.</i> 'Maria says that both the father and the sons have gone shopping.'
	SPS	<i>Maria sagt, dass sowohl der Vater als auch die Söhne einkaufen gegangen ist.</i> 'Maria says that both the father and the sons has gone shopping.'
	PSP	<i>Maria sagt, dass sowohl die Söhne als auch der Vater einkaufen gegangen sind.</i> 'Maria says that both the sons and the father have gone shopping.'
	PSS	<i>Maria sagt, dass sowohl die Söhne als auch der Vater einkaufen gegangen ist.</i> 'Maria says that both the sons and the father has gone shopping.'
	SSP	<i>Maria sagt, dass sowohl der Vater als auch der Sohn einkaufen gegangen sind.</i> 'Maria says that both the father and the son have gone shopping.'
	SSS	<i>Maria sagt, dass sowohl der Vater als auch der Sohn einkaufen gegangen ist.</i> 'Maria says that both the father and the son has gone shopping.'
<i>weder ... noch</i> 'neither ... nor'	SPP	<i>Maria sagt, dass weder der Vater noch die Söhne einkaufen gegangen sind.</i> 'Maria says that neither the father nor the sons have gone shopping.'
	SPS	<i>Maria sagt, dass weder der Vater noch die Söhne einkaufen gegangen ist.</i> 'Maria says that neither the father nor the sons has gone shopping.'
	PSP	<i>Maria sagt, dass weder die Söhne noch der Vater einkaufen gegangen sind.</i> 'Maria says that neither the sons nor the father have gone shopping.'
	PSS	<i>Maria sagt, dass weder die Söhne noch der Vater einkaufen gegangen ist.</i> 'Maria says that neither the sons nor the father has gone shopping.'
	SSP	<i>Maria sagt, dass weder der Vater noch der Sohn einkaufen gegangen sind.</i> 'Maria says that neither the father nor the son have gone shopping.'
	SSS	<i>Maria sagt, dass weder der Vater noch der Sohn einkaufen gegangen ist.</i> 'Maria says that neither the father nor the son has gone shopping.'

We created 12 versions of each experimental sentence. Eight of these contained subject phrases with one singular and one plural noun phrase (number conflict conditions). By manipulating verb number and the relative ordering of the two conjuncts we created four conflict conditions for each conjunction type. Our conflict conditions were critical for assessing the effects of conjunct proximity on the acceptability of singular vs. plural agreement. We created two further conditions for each conjunction type containing two singular noun phrases (labelled SSP and SSS in Table 1), which served as our baseline conditions. The baseline conditions should inform us about the acceptability of singular vs.

plural agreement for the two conjunctions under investigation in the absence of any plural feature introduced by the conjuncts themselves.

The experimental sentences were distributed across 12 presentation lists in a Latin square design, pseudo-randomised and mixed with 30 fillers, resulting in 54 sentences per list. The fillers resembled our experimental items in that they also contained complement clause constructions such as *The newspapers say that ...*. Half of the fillers contained grammatical errors of various kinds, the other half was grammatically and semantically well-formed.

3.1.3. Procedure

The experiment was designed as a web-based questionnaire using google.forms, and the 12 presentation lists were distributed equally among the participants. Participants read one sentence at a time and continued to the next one via a button press after providing their rating. Sentences were rated on a 5-point Likert scale ranging from 1 ('very acceptable') to 5 ('very unacceptable'), a scale which resembles the grading system used in German schools, where 1 corresponds to 'very good' and 5 to 'insufficient'. Participants were instructed to follow their intuition about the sentences' acceptability and that there were not necessarily any right or wrong answers. Each participant received a web link to one of the twelve lists and could complete the experiment at home.

One example sentence was provided in the introduction text, but without an answer so as to not to bias the participants towards a certain rating. In theory it was possible for participants to go back and change their ratings, but this was not advertised anywhere, so we do not assume that this happened very often. The whole questionnaire could be completed in about 20 to 30 min. Participants received either course credit or a small fee for participation. Before the experiment began, participants answered a few questions about their age, sex, other languages they had learnt, whether or not they had grown up with more than one language and whether or not they suffered from any neurological and/or developmental disorders. By checking a corresponding box, they provided consent for their data to be used and processed anonymously for scientific purposes.

3.1.4. Data Cleaning and Analysis

The ratings were first z-transformed and then analysed with a series of linear mixed-effects models, using the lme4 packages of R (Bates et al. 2015). Fixed factors included verb number (singular vs. plural), conjunction (*sowohl ... als auch* vs. *weder ... noch*) and proximity ('number match' vs. 'no match' with the second conjunct). In order to find the best-fit random slope structure we first constructed a maximal model including random intercepts and slopes for all factors and their interactions. When this model failed to converge we iteratively removed random slopes starting with the random slope at the highest level (i.e., three-way interactions) and removing the term (by-participant or by-item) that explained the least variance. Following the suggestion of Barr et al. (2013), this procedure was repeated until the model converged or did not improve any further according to its Akaike information criterion (AIC) (a measure penalizing complexity, such that the model with the lower AIC is the better fit; (Venebles and Ripley 2002)). The best-fit model for each analysis is reported in the Results section.

The four baseline conditions were analysed separately as proximity is not a factor here. A second model was run for the eight number conflict conditions. For main effects and overall interactions, we employed sum-coded contrasts (−0.5, 0.5) to the factors. For effects within conjunction or verb number we employed treatment contrasts and relevelled for these factors.

3.2. Results

Mean ratings for each condition are presented in Table 2. Plural verbs were rated more favourably than singular verbs across all subject types, but this preference appears to be modulated by both conjunct proximity and the type of conjunction used.

Table 2. Mean non-transformed acceptability ratings (SDs in parentheses) per condition for both conjunctions, Experiment 1 (S = singular, P = plural).

Conjunction	SPS	PSS	SPP	PSP	SSP	SSS
<i>sowohl ... als auch</i> ‘both ... and’	4.52 (0.85)	4.33 (0.89)	1.35 (0.83)	1.39 (0.77)	1.9 (1.21)	3.18 (1.47)
<i>weder ... noch</i> ‘neither ... nor’	4.46 (0.8)	4.18 (1.09)	1.53 (0.89)	1.56 (0.87)	2.22 (1.43)	2.74 (1.44)

We first report the results from the four baseline conditions with double singular conjuncts (SSP and SSS; see Table 3). Besides a main effect of verb number, reflecting the overall preference for plural agreement, we found a significant Verb Number \times Conjunction interaction. This was due to *sowohl ... als auch* eliciting a larger difference in participants’ ratings of the two verb forms (Estimate = 0.87, $SE = 0.16$, $t = 5.54$) in comparison to *weder ... noch* (Estimate = 0.37, $SE = 0.16$, $t = 2.34$).

Table 3. Summary of the statistical results for the four baseline conditions, Experiment 1 (ME = main effect).

	Estimate	SE	t
ME Verb Number	0.62	0.15	4.25
ME Conjunction	−0.04	0.06	−0.67
Verb Number \times Conjunction	0.49	0.13	3.9

R formula: `lmer(scale(ratings)~Verb \times Conjunction + (1 + Verb + Conjunction | Item) + (1 + Verb + Conjunction | Participant), data = subset_baseline-conditions).`

The model outputs for the analysis of the number conflict conditions is shown in Table 4. We found main effects of verb number and proximity, as well as a significant interaction between the two. The interaction reflected the fact that the proximity effect was significant for singular verbs (Estimate = 0.13, $SE = 0.04$, $t = 3.63$) but not for plural verbs (Estimate = 0.02, $SE = 0.04$, $t = 0.5$), with a singular second conjunct (PSS) rendering singular verbs more acceptable compared with a singular first conjunct (SPS). There was also a significant interaction between verb number and conjunction, due to the *sowohl ... als auch* conditions showing a larger difference between participants’ ratings for plural vs. singular verbs (Estimate = 1.8, $SE = 0.06$, $t = 29.7$) compared with the *weder ... noch* conditions (Estimate = 1.7, $SE = 0.07$, $t = 23.21$).

Table 4. Summary of the statistical results for number conflict conditions, Experiment 1.

	Estimate	SE	t
ME Verb Number	2.9	0.1	28.5
ME Proximity	0.13	0.04	2.95
ME Conjunction	0.04	0.04	0.8
Verb Number \times Proximity	0.2	0.1	2.19
Verb Number \times Conjunction	−0.28	0.1	−3.12
Proximity \times Conjunction	−0.03	0.05	−0.5
Verb Number \times Proximity \times Conjunction	−0.06	0.1	−0.62

R formula: `lmer(scale(ratings)~Verb \times Conjunction \times Prox + (1 + Conjunction | Item) + (1 + Verb + Prox | Participant), data = subset_critical-conditions).`

3.3. Summary and Discussion

The results from our scalar rating task reveal an overall preference for plural agreement that was modulated both by the type of conjunction and by conjunct proximity. Rather than giving rise to a preference for singular agreement (cf. Eisenberg 1989), the presence of negation in *weder ... noch* coordination merely reduced the acceptability of plural agreement, in line with what was reported by Wegerer (2012). For number conflict cases,

we found that a singular second conjunct increased the acceptability of singular agreement, whereas conjunct proximity did not affect participants' ratings of plural agreement. Note that the observed singular–plural asymmetry is in the opposite direction of the singular–plural asymmetry that has frequently been reported in the agreement attraction literature, with plural attractors more likely than singular ones to trigger erroneous verbal agreement (e.g., [Bock and Miller 1991](#)). For example, when asked to complete a binominal subject phrase such as 'The key to the cabinets ... ', speakers are more likely to produce an agreement error when the attractor noun (here, 'cabinets') is plural compared with when it is singular. From the perspective of cue-based retrieval models of sentence processing (e.g., [Lewis and Vasishth 2005](#)), this asymmetry is usually attributed to plural-marked noun phrases being more salient in memory and thus more likely to be mis-retrieved compared with singular noun phrases (e.g., [Staub 2009](#)). Finding this asymmetry reversed in our data provides further support for the claim that the phenomenon of variable agreement with conjoined subjects is of a different nature than agreement attraction ([Keung and Staub 2018](#); [Foppolo and Staub 2020](#)). As the former involves permissible variation and the latter grammatical errors, the two phenomena may not in fact be directly comparable. The results from Experiment 1 will be discussed further in our General Discussion.

4. Experiment 2: Forced-Choice Sentence Completion

Our second experiment used a timed binary sentence completion task with externally paced word-by-word stimulus presentation ([Staub 2009](#)). This task resembled language production in that participants were asked to complete a sentence fragment by selecting an appropriate verb, and the speeded stimulus presentation reduced the likelihood of participants relying on prescriptive norms or metalinguistic knowledge. Measuring participants' response times could additionally provide an indication of how difficult they found the choice between a singular or plural verb across our experimental conditions.

4.1. Method

4.1.1. Participants

Participants included 46 German native speakers (ten male, mean age: 23.5; SD: 4.6, range 18–35) from the Potsdam and Berlin area who were recruited via the University's participant database. All of them reported to have been raised monolingually. Twenty-nine participants held a high school diploma and were university students at the time of testing, and 27 had completed a university degree. All participants had normal or corrected to normal vision and reported no language or neurological impairment. They gave consent prior to the experiment by checking the box explaining how their data would be processed and used.

4.1.2. Materials

We used the same materials as in Experiment 1 (see Table 1), the only difference being that participants had to actively choose either a plural or singular auxiliary as the sentence-final word. The number of experimental conditions was thus reduced to six, comprising two double-singular baseline and four number conflict conditions. The 24 critical sentences were mixed with 24 sentences from a different experiment and with 29 additional fillers with varying structures. We created six presentation lists in a Latin square design, with each list including 77 sentences in total.

4.1.3. Procedure

The experiment was programmed using the platform Ibex Farm for web-based experiments ([Drummond 2013](#)). The subject phrases were presented word-by-word in black letters on a white background. The presentation rate was preset at 500 ms per word, with a 50 ms inter-word interval. After the last word, two response options appeared (*ist* 'is' vs. *sind* 'are') and remained visible until participants pressed a key or if a set time-out of 2000 ms was reached. Participants were instructed to choose the auxiliary they consid-

ered to be the grammatically appropriate sentence continuation by pressing one of two designated keys on the keyboard (F = *ist* or J = *sind*). Participants received a warning message when reaching the time-out but no other feedback. After each response, participants pressed a key to start the next trial. Critical sentences and fillers were randomised on a by-participant basis. Each experimental session began with eight practice trials. Both participants' verb choices and their response times were recorded. Participants completed the task remotely via a web link. The experiment took about 20 min to complete, and participants received either course credit or a small fee for participation.

4.1.4. Data Cleaning and Analysis

We analysed both participants' response times and the proportions of singular vs. plural responses. Trials exceeding the 2000 ms time-out were removed prior to analysis, affecting 0.77% of all data points. Trials that were responded to faster than 50 ms were also removed, leading to the further exclusion of 0.71% of the data points. Response times were first log-transformed and then analysed with linear mixed-effects models using the lme4 package, with crossed random effects for Subject and Item (Baayen et al. 2008). Fixed factors in the analysis of the number conflict conditions were conjunction (*sowohl ... als auch* vs. *weder ... noch*) and conjunct order (singular-plural vs. plural-singular). For determining the best-fit random slope structure we used the same method as in Experiment 1. We again analysed the baseline conditions separately from the number conflict conditions because for the former, conjunct order is not a meaningful factor.

Responses were coded with 0 and 1 according to their number (i.e., singular response = 0, plural response = 1) and analysed with generalized linear mixed-effects models (binomial family and the bobyqa optimizer) with crossed random effects for Subject and Item, and the same fixed factors as described above. The best-fit model was determined the same way as for response times and in Experiment 1. For main effects and interactions, we employed sum-coded contrasts to the factors; other within-analyses (e.g., within conjunctions) were done with treatment contrasts and releveling.

4.2. Results

Participants chose more plural than singular verbs across all experimental conditions, but there were differences between our experimental conditions such that a second plural conjunct elicited the highest number of plural responses and the double-singular baseline conditions the lowest. Table 5 provides an overview of participants' proportions of plural verb choices and their response times per condition.

Table 5. Proportions of plural responses and response times (RT) in milliseconds (SDs in parentheses) per condition for both conjunctions, Experiment 2 (SG = singular, PL = plural).

Conjunction	Measure	SG-PL	PL-SG	SG-SG
<i>sowohl ... als auch</i> 'both ... and'	Plural Response	0.96 (0.19)	0.79 (0.41)	0.71 (0.46)
	RT	495 (233)	611 (366)	572 (372)
<i>weder ... noch</i> 'neither ... nor'	Plural Response	0.97 (0.18)	0.77 (0.42)	0.63 (0.48)
	RT	538 (285)	613 (360)	594 (346)

We first compared participants' responses to the double-singular baseline conditions for the two conjunctions. Although numerically, fewer plural choices were made for *weder ... noch* than for *sowohl ... als auch*, there was no significant difference between the two conjunctions (Estimate = 0.42, SE = 0.34, $t = 1.24$). The model outputs for the number conflict conditions are shown in Table 6.

Table 6. Summary of the statistical analyses of participants' verb choices in the number conflict conditions, Experiment 2.

	Estimate	SE	z
ME Conjunction	0.04	0.4	0.1
ME Order	2.24	0.32	6.9
Conjunction \times Order	0.3	0.66	0.5

R formula: `glmer(responses ~ Order \times Conjunction + (1 | Item) + (1 + Order | Participant)`, family = binomial, control = `glmerControl(optimizer = "bobyqa")`, data).

There was a main effect of conjunct order that was not modulated by conjunction type, with PL-SG subjects eliciting significantly fewer plural responses compared with SG-PL subjects for both conjunctions (*sowohl ... als auch*: Estimate = -2.09 , $SE = 0.44$, $z = -4.66$; *weder ... noch*: Estimate = -2.4 , $SE = 0.47$, $z = -5.07$).

Our analysis of participants' response times yielded a similar picture (Table 7). There was no difference between the two conjunctions in the baseline conditions (Estimate = 0.06 , $SE = 0.08$, $t = 0.8$), but we found a significant main effect of order for the number conflict conditions. This effect reflected the fact that participants responded more quickly to the SG-PL conditions than to the PL-SG conditions. There were no other significant main effects or interactions.

Table 7. Summary of the statistical analyses of participants' response times for the number conflict conditions, Experiment 2.

	Estimate	SE	t
ME Conjunction	0.03	0.04	0.64
ME Order	-0.11	0.04	2.87
Conjunction \times Order	0.04	0.08	0.6

R formula: `lmer(log(RT) ~ Conjunction \times Order + (1 + Conjunction \times Order | Item) + (1 + Connector + Order | Participant)`, data).

4.3. Summary and Discussion

Participants' verb choices showed a clear preference for plural over singular agreement, and conjunct order affected participants' performance such that singular second conjuncts attenuated the plural preference and also led to longer response times compared with plural second conjuncts. These findings are in line with the results from Experiment 1. Neither participants' agreement choices nor their response times were reliably affected by the type of conjunction in Experiment 2, however. The absence of semantic effects in our second experiment might be due to the nature of the task, which did not allow participants to re-read the subject phrase and left them comparatively little time to reflect consciously on the decision for a singular or plural verb. The possibility that added processing pressure might reduce the likelihood of a conjunction's semantic type affecting agreement computation is examined further in Experiment 3.

5. Experiment 3: Self-Paced Reading

In Experiment 3 we used a self-paced reading acceptability judgement task to obtain both a processing measure of German speakers' agreement preferences and their end-of-sentence evaluations, and to examine the extent to which these are modulated by conjunct proximity and conjunction type. As the results from Experiments 1 and 2 support claims to the effect that *sowohl ... als auch* ('both ... and') and *weder ... noch* ('neither ... nor') are essentially of the same semantic type (Wurmbrand 2008), we decided to compare additive *sowohl ... als auch* with the disjunctive connector *entweder ... oder* ('either ... or') here. This also allowed us to test whether agreement with disjunctively conjoined subjects is more strongly influenced by conjunct order than agreement with additively conjoined subjects, as has been reported by Keung and Staub (2018) for English non-correlative *or* vs. *and*. This prediction can be derived from the claim that disjunctively conjoined subjects

lack a number specification (e.g., [Foppolo and Staub 2020](#)), so that number agreement must be determined by other factors including conjunct order.

5.1. Method

5.1.1. Participants

Thirty-four adult native German speakers were recruited from the Potsdam and Berlin area via the University's participant database and through personal contacts, one of whom was excluded because of their low acceptance rate of grammatical filler sentences (<50%). The remaining 33 participants (eight male) had a mean age of 29.4 years (SD: 14.1, range 18–71), had normal or corrected-to-normal vision and reported no language or neurological disorder. They all reported to have been raised in monolingual German-speaking households. As was also the case in Experiments 1 and 2, our participants' educational level was generally rather high: 23 participants held a high school diploma and were studying for a university degree at the time of testing, nine had completed a university degree, and one had completed vocational training. They gave consent prior to the experiment in the same way as in Experiments 1 and 2.

5.1.2. Materials

We adapted the stimulus items from Experiment 1 to create 24 stimulus sets as shown in Table 8. We used main clauses instead of embedded ones to ensure that the finite verb appeared sentence-medially rather than sentence-finally. This was important because in self-paced reading tasks, reading times at the sentence-final segment may be elevated due to sentence-final 'wrap-up' processes taking place which mask or interfere with processing effects resulting from the experimental manipulation under investigation. All experimental sentences started with a complex subject phase conjoined with *sowohl ... als auch* ('both ... and') or *entweder ... oder* ('either ... or'). The finite verb was either singular *ist* ('is') or plural *sind* ('are'). Manipulating conjunction type, verb number and the relative ordering of singular and plural conjuncts yielded a total of eight experimental conditions. As Experiment 3 sought to investigate the interaction between conjunction type and conjunct proximity, we only included number conflict conditions here. The experimental stimuli were distributed across eight presentation lists, pseudo-randomised and mixed with 24 sentences from a different experiment investigating verbal agreement with pseudo-partitive subjects and 25 filler sentences with varying structures, resulting in a total number of 73 sentences per list.

Table 8. Example stimulus set, Experiment 3 (S = singular, P = plural).

Condition		Example
<i>sowohl ... als auch</i> 'both ... and'	SPP	<i>Sowohl der Vater als auch die Söhne sind einkaufen gegangen.</i> 'Both the father and the sons have gone shopping.'
	SPS	<i>Sowohl der Vater als auch die Söhne ist einkaufen gegangen.</i> 'Both the father and the sons has gone shopping.'
	PSP	<i>Sowohl die Söhne als auch der Vater sind einkaufen gegangen.</i> 'Both the sons and the father have gone shopping.'
	PSS	<i>Sowohl die Söhne als auch der Vater ist einkaufen gegangen.</i> 'Both the sons and the father has gone shopping.'
<i>entweder ... oder</i> 'either ... or'	SPP	<i>Entweder der Vater oder die Söhne sind einkaufen gegangen.</i> 'Either the father or the sons have gone shopping.'
	SPS	<i>Entweder der Vater oder die Söhne ist einkaufen gegangen.</i> 'Either the father or the sons has gone shopping.'
	PSP	<i>Entweder die Söhne oder der Vater sind einkaufen gegangen.</i> 'Either the sons or the father have gone shopping.'
	PSS	<i>Entweder die Söhne oder der Vater ist einkaufen gegangen.</i> 'Either the sons or the father has gone shopping.'

5.1.3. Procedure

We programmed the experiment to be run on Ibex Farm (Drummond 2013) using the non-cumulative moving-window technique (Just et al. 1982). Experimental and filler items were presented in black letters against a white background in 16 px Times New Roman font. One word was presented at a time (with *als auch* presented as a single segment) and was replaced by underscores when a participant pressed the space bar to bring up the next word. Underscores for the whole sentence remained visible during each trial. The final word in a sentence appeared with a full stop, and after pressing the space bar again, participants had to provide a binary acceptability judgement by pressing J for ‘yes’ or K for ‘no’, or by clicking on one of the two answer options shown on screen. The main experiment was preceded by eight practice trials. There were no pre-programmed breaks during the experiment, which could be completed in about 20 min. Participants received a link to the experiment and completed it remotely. A progress bar shown above the stimulus sentences allowed them to keep track of their progress during the experiment.

5.1.4. Data Cleaning and Analysis

Excessively long reading times of above 2000 ms and extremely short reading times below 200 ms were removed (affecting 0.71% of the data), following the suggestions of Jegerski (2014). From the remaining data residual reading times (RRT) were calculated with linear modelling on the log-transformed reading times, with word length as the predictor. RRTs were calculated on all items other than those that were excluded prior to analysis. RRTs were analysed for the critical verb (Segment 7: *ist* vs. *sind*) and for the two adjacent presentation segments, the pre-critical Segment 6 and the spillover Segment 8.

Statistical analyses were conducted on RRTs using a series of linear mixed-effects models with random slopes by Item and Participants (compare Experiment 2). Fixed factors included conjunction (*sowohl ... als auch* vs. *entweder ... oder*), conjunct order (SP vs. PS) and verb number (singular vs. plural). RRT at the pre-interest region was added as a co-variate so as to control for potential effects of this region on a given interest region (Bartek et al. 2011). Participants’ end-of-sentence acceptability judgements were analysed using generalized linear mixed-effects models similar as described above for Experiment 2. For this experiment we used a bottom-up approach to find the best-fit model. First, we ran a model with empty random structure, and then iteratively added factors by Item and/or by Participant. If a factor did not improve the model, we replaced it with the next factor, and so forth. If the model improved, we added another factor, and as a last step we also added interactions between factors. This was continued until adding a factor and/or an interaction did not improve the model according to its AIC, or if the model did not converge any more. The best-fit model for each analysis is reported in the Results section.

5.2. Results

We first consider the reading time results. Table 9 provides an overview of participants’ mean raw reading times per word and condition, and Table 10 shows the mean RRTs for the critical verb (Segment 7). A summary of the statistical analyses for this region is provided in Table 11. The results show a significant main effect of verb number reflecting shorter RRTs for plural compared with singular verbs but no other main effects or interactions. The analyses of RRTs for the pre-critical and spillover segments yielded no significant main effects or interactions.

Table 9. Mean reading times in milliseconds (SDs in parentheses) per word and condition for both conjunctions, Experiment 3.

Condition		1	2	3	4	5	6	7	8	9
<i>sowohl ... als auch</i> 'both ... and'	PSP	466 (193)	430 (130)	522 (229)	527 (210)	494 (246)	546 (218)	533 (262)	501 (185)	773 (389)
	PSS	496 (234)	451 (160)	549 (261)	526 (208)	476 (154)	576 (271)	618 (374)	520 (267)	761 (422)
	SPP	441 (160)	459 (193)	502 (260)	491 (176)	440 (151)	552 (234)	518 (203)	491 (181)	756 (380)
	SPS	481 (222)	466 (179)	526 (266)	506 (228)	471 (170)	581 (258)	617 (335)	512 (236)	632 (363)
<i>entweder ... oder</i> 'either ... or'	PSP	520 (294)	433 (121)	562 (289)	500 (193)	436 (131)	541 (271)	560 (311)	508 (225)	761 (412)
	PSS	475 (198)	444 (146)	560 (285)	484 (169)	451 (161)	563 (228)	574 (331)	537 (278)	763 (434)
	SPP	478 (178)	451 (191)	537 (280)	460 (157)	463 (212)	634 (360)	535 (269)	540 (276)	780 (418)
	SPS	498 (216)	453 (188)	500 (196)	435 (108)	450 (171)	624 (313)	556 (238)	515 (192)	662 (329)

Table 10. Mean residual reading times at the critical verb across conditions, Experiment 3 (S = singular, P = plural).

Conjunction	PSP	PSS	SPP	SPS
<i>sowohl ... als auch</i> 'both ... and'	0.08 (0.27)	0.195 (0.36)	0.07 (0.27)	0.21 (0.34)
<i>entweder ... oder</i> 'either ... or'	0.09 (0.31)	0.15 (0.33)	0.066 (0.29)	0.15 (0.29)

Table 11. Summary of the statistical analyses of participants' reading times at the critical verb segment, Experiment 3.

	Estimate	SE	t
ME Verb Number	0.09	0.02	3.88
ME Order	0.01	0.02	0.64
ME Conjunction	0.03	0.02	1.29
Verb Number × Order	−0.05	0.04	−0.16
Verb Number × Conjunction	0.04	0.04	1.0
Order × Conjunction	0.02	0.04	0.41
Verb Number × Order × Conjunction	0.02	0.08	0.26

R formula: $\text{lmer}(\text{rRTregion7} \sim \text{Verb} \times \text{Order} \times \text{Conjunction} + \text{scale}(\text{rRTregion6}) + (1 \mid \text{Item}) + (1 + \text{Verb} \mid \text{participant}), \text{data})$.

A summary of participants' end-of-sentence acceptability judgements is shown in Table 12, and the statistical results are presented in Table 13. Plural verbs were overwhelmingly preferred, but singular verbs were accepted more readily if the second conjunct was singular rather than plural. This was reflected in a significant interaction between verb number and conjunction order, which we found in addition to a significant main effect of verb number. Sentences containing plural verbs were accepted less often for *entweder ... oder* compared with *sowohl ... als auch*, but the main effect of conjunction did not prove significant. There were no other main effects or interactions.

Table 12. Proportions of end-of-sentence acceptances (SDs in parentheses) per condition, Experiment 3 (S = singular, P = plural).

Conjunction	PSP	PSS	SPP	SPS
<i>sowohl ... als auch</i> 'both ... and'	0.92 (0.3)	0.17 (0.4)	0.99 (0.1)	0.02 (0.1)
<i>entweder ... oder</i> 'either ... or'	0.86 (0.4)	0.17 (0.4)	0.94 (0.24)	0.01 (0.1)

Table 13. Summary of the statistical analyses of participants' end-of-sentence acceptability judgements, Experiment 3.

	Estimate	SE	z
ME Verb Number	−6.75	0.65	−10.4
ME Order	−0.68	0.45	−1.49
ME Conjunction	0.82	0.44	1.84
Verb Number × Order	−4.6	0.9	−5.05
Verb Number × Conjunction	−0.88	0.89	−0.98
Order × Conjunction	1.03	0.89	1.15
Verb Number × Order × Conjunction	−0.28	1.79	−0.16

R formula: `glmer(responses ~ Conjunction × Verb × Order + (1 | Item) + (1 + Verb | Participant)`, family = binomial, control = `glmerControl(optimizer = "bobyqa")`, data).

5.3. Summary and Discussion

The results from Experiment 3 confirm once again that if the two conjuncts differ in their grammatical number, German speakers prefer plural over singular verbs. During online reading, encountering a singular rather than a plural verb disrupted processing in the same way for both additive *sowohl ... als auch* and disjunctive *entweder ... oder* irrespective of conjunct order. The latter factor only affected participants' end-of-sentence judgements. As was also the case in Experiment 2, we found no reliable effects of conjunction type. This supports the hypothesis raised above that semantic factors are less likely to affect agreement computation in processing tasks or in tasks with added processing pressure, compared with untimed tasks. The results from Experiment 3 will be further discussed in the next section, together with those from Experiment 1 and 2.

6. General Discussion

Agreement with coordinated subjects is influenced by several syntactic and semantic factors (e.g., Corbett 2006) as well as by usage frequency (Goschler 2014; Lorimor et al. 2018). The present study focused on two of these factors, examining how the semantic type of conjunction and a conjunct's linear proximity to the verb affect German speakers' number agreement preferences with correlatively conjoined subjects. We can report three main findings: (i) plural agreement is generally preferred, (ii) conjunct proximity affected participants' acceptability judgements and production choices but not their online reading times and (iii) semantic differences between individual conjunctions only affected participants' offline acceptability ratings. We will discuss each of these findings in turn.

6.1. Preference for Plural Agreement

Our finding that plural agreement is preferred over singular agreement was consistent across all three experiments. We observed a general plural agreement preference not only for number conflict cases but also when two singular noun phrases were conjoined (Experiments 1 and 2), as well as during online reading (Experiment 3). Participants' plural agreement preference was stronger for *sowohl ... als auch* ('both ... and') than for the negative-additive conjunction *weder ... noch* ('neither ... nor') in Experiment 1, as was previously reported by Wegerer (2012) for a small number of stimulus items. Our finding that plural agreement was preferred for double-singular subjects for both conjunctions fails to confirm claims to the effect that singular agreement is more appropriate or preferred for subjects conjoined by *weder ... noch* (e.g., Eisenberg 1989).

Although we could not measure directly how correlatively conjoined subjects were syntactically encoded, note that a general plural agreement preference would be expected for both double-singular subjects and number conflict cases according to the ConjP analysis in (2) above, which involves noun phrase coordination, under the assumption that the ConjP carries a plural feature (Johannessen 2005). As the ConjP analysis in (2) is structurally more economical than the alternative analysis in (3), which involves clausal coordination and ellipsis, the former should be preferred from an economy perspective, other things

being equal. This might be the reason why plural agreement is preferred for two singular noun phrases linked by additive conjunctions even if a conjunction is negative-additive. We also found plural agreement easier to process and more likely to be accepted than singular agreement in number conflict cases in Experiment 3, even for disjunctively conjoined subjects, a finding we will discuss below.

6.2. The Role of Conjunct Proximity

Previous experimental studies on non-correlative coordination in English have revealed clear effects of linear order on speakers' number agreement preferences (e.g., Haskell and MacDonald 2005; Keung and Staub 2018). Our results show that closest conjunct agreement is more limited than might have been expected, however, both in the light of previous findings and according to what some scholars have claimed for present-day German (e.g., Klein 2004). In Experiment 1, we found an asymmetrical proximity effect, with singular second conjuncts increasing the acceptability of singular agreement but no corresponding increase in the acceptability of plural agreement if the second conjunct was plural. Conjunct proximity affected participants' performance in a similar way in Experiment 2, with more singular responses being provided if the second conjunct was singular (PL-SG) compared with when it was plural (SG-PL). This finding fits with Peterson (1986) observation on agreement with *either* ... *or* coordination in English. Singular second conjuncts also gave rise to elevated response times relative to plural second conjuncts, indicating that participants took longer to decide on a verb form in the PL-SG than in the SG-PL conditions. Interestingly though, we found no conjunct proximity effects in the analysis of participants' online reading times in Experiment 3. Conjunct proximity only affected participants' end-of-sentence judgements, such that a singular second conjunct increased the likelihood of a singular verb being considered acceptable, as was also the case in Experiment 1.

For number conflict cases, agreement with the second conjunct would be expected according to an analysis along the lines of (3) above involving clausal coordination plus ellipsis, although this analysis does not by itself account for the observed singular-plural asymmetry. The absence of any conjunct proximity effects during online processing in Experiment 3 could be taken to indicate that comprehenders' initial (and presumably, unconscious) agreement computation is mediated by a ConjP analysis that involves noun phrase coordination (2), on the assumption that ConjPs trigger plural agreement by default. In Experiment 3, plural default agreement was reflected in overall shorter processing times for plural than for singular verbs. The presence of an initial correlative particle (*sowohl* or *either*) might have led to the generation of a ConjP, possibly including its default [+plural] specification, prior to participants' processing of the second conjunct (compare Staub and Clifton 2006) and might also have triggered the expectation of a plural verb.

We observed conjunct proximity effects in production (i.e., sentence completion) and whole-sentence acceptability measures only. Note that in end-of-sentence judgement tasks—but not during online reading—participants had time to reflect upon their agreement preference, to consult their metalinguistic knowledge, and possibly even to revise their initial encoding of the subject phrase. Similarly, in the forced-choice sentence completion task used in Experiment 2, two words followed the presentation of the subject phrase (e.g., ... *dass sowohl der Vater als auch die Söhne einkaufen gegangen* __; lit. 'that both the father and the sons shopping gone __'). This might have given participants some time to plan their response ahead of being prompted to provide it, possibly switching from analysis (2) to an analysis along the lines of (3) on some occasions. The materials used in Experiment 3, in contrast, contained singular or plural auxiliaries in sentence-medial position that directly followed the subject phrase, leaving little time for reanalysis or conscious reflection during processing. Alternatively, the conjunct proximity effects seen in Experiment 2, which used externally paced or 'speeded' stimulus presentation, may have come about as a result of processing constraints that led participants to focus more on the number marking of the local noun phrase than they did during self-paced reading.

The observed selectivity of linear order effects, with conjunct proximity facilitating singular but not plural agreement, and the absence of such effects in our online processing measure in Experiment 3 argue against conjunct proximity effects being the result of faulty memory retrieval, which has been proposed as a likely cause of agreement attraction errors (e.g., [Staub 2009](#)).

6.3. Effects of Conjunction Type

Semantic differences between the conjunctions under investigation had surprisingly little influence on participants' performance patterns. Conjunction type only affected the degree to which plural agreement was preferred in our scalar rating task (Experiment 1), with negative-additive *weder ... noch* showing a weaker preference for plural agreement than additive *sowohl ... als auch*. No effects of conjunction type were found in Experiment 2, with both *sowohl ... als auch* and *weder ... noch* eliciting significantly more plural than singular agreement choices. These findings are consistent with [Wurmbrand \(2008\)](#) proposal that *weder ... noch* is an additive rather than a disjunctive conjunction.

In Experiment 3 we compared two conjunctions that differed more strongly in their semantic make-up, additive *sowohl ... als auch* and disjunctive *entweder ... oder* ('either ... or'). Unlike subject phrases containing an additive conjunction, subject phrases involving a disjunctive connector have been argued to be unspecified for number (e.g., [Foppolo and Staub 2020](#)). We thus expected subjects linked by *entweder ... oder* to yield larger conjunct proximity effects compared with subjects linked by *sowohl ... als auch*, which we assume to be specified as [+plural]. This prediction was not borne out, however: Effects of conjunct order were absent from our reading-time data, and participants' end-of-sentence acceptability judgements showed an effect of conjunct order that was unmodulated by conjunction type. Although we did not run a separate acceptability judgement task for the conjunction *entweder ... oder* that was comparable to Experiment 1 in that it also tested double-singular conditions, recall that [Wegerer \(2012\)](#) found a 45% acceptance rate for plural agreement for sentences of this type. This figure is much higher than we would expect given that the disjunctive nature of *entweder ... oder* makes it difficult to conceive of the two subject parts as a plurality.

Taken together, our results indicate that plural agreement (i) is the default agreement for subjects conjoined by a positive or negative-additive correlative conjunction regardless of the number features carried by the individual subject parts and (ii) is also the preferred agreement option for subjects conjoined by disjunctive *entweder ... oder* in number conflict cases.

The fact that effects of conjunction type were seen in Experiment 1 only is likely to be due to differences in the nature of our experimental tasks. Being asked to evaluate a sentence's acceptability in the absence of any processing pressure in Experiment 1, participants were able to consider and weigh up both grammatical and semantic cues before providing their judgements. The latter include the presence of negation in the semantic representation of *weder ... noch*, which may have made it more difficult to interpret the subject phrase as denoting a set of multiple individuals compared with subjects conjoined by *sowohl ... als auch*. In timed or processing tasks as in Experiments 2 and 3, on the other hand, processing pressure may prevent details of a coordinating conjunction's semantic make-up from influencing agreement choices.

Our observation that conjunction type only affected participants' offline acceptability judgements—but none of our other experimental measures—does not necessarily mean that semantic factors have no influence on initial agreement computation. One factor that we did not investigate here is the subject phrase's notional plurality, for example, which [Brehm and Bock \(2017\)](#) found to affect English speakers' verb form choices in a timed sentence completion task similar to our Experiment 2 (compare also [Lorimor et al. 2018](#); [Lorimor et al. 2016](#)).

6.4. Implications for Theoretical Modelling

Our finding that participants' plural agreement preference was gradient rather than categorical and was modulated by conjunction type and conjunct order indicates that default plural agreement interacts with other factors in determining the acceptability of plural vs. singular verb forms and speakers' production choices. We suggest that variable number agreement with conjoined subjects can best be accounted for by constraint-based models of grammar (e.g., Legendre et al. 1990; Pater 2009; Smolensky et al. 2014), which are similar in spirit to Peterson (1986) proposal of different strategies interacting in determining speakers' agreement choices. Rather than assuming categorical distinctions between 'grammatical' and 'ungrammatical' forms, this kind of approach to (morpho-)syntactic variation allows for different variants to be grammatically licit whilst also accounting for the relative likelihood that a given variant is chosen; compare e.g., (Jessen et al. (n.d.) for modelling variable number agreement with pseudo-partitive subjects in terms of weighted interacting constraints.

Focusing on disjunctively coordinated subjects, Peterson (1986) tried to determine a hierarchy of different constraints guiding speakers' agreement choices. PLURAL WINS favours plural over singular agreement, PROXIMITY favours agreement with the closest conjunct, whilst FIRST CONJUNCT WINS favours initial conjunct agreement. Table 14 provides an overview of the predictions made by each of these constraints for our number conflict conditions.

Table 14. Predictions made by Peterson (1986) constraints for agreement in number conflict cases (S = singular, P = plural).

Constraint	SPS	PSS	SPP	PSP
PLURAL WINS	—	—	+	+
PROXIMITY	—	+	+	—
FIRST CONJUNCT WINS	+	—	—	+

Our results are broadly in line with Peterson (1986) findings on English reported in Section 2. The acceptability ratings we obtained in Experiment 1 showed that singular agreement was generally deemed worse than plural agreement, in accordance with the PLURAL WINS constraint. At the same time, a singular second conjunct improved the rating of sentences with singular verbs compared with those containing a singular first conjunct, suggesting that the PROXIMITY constraint also carries some force. Evidence for a general plural preference modulated by conjunct order were also found in Experiments 2 and 3. The rating pattern we observed in Experiment 1 ($SPS < PSS < SPP = PSP$) indicates that PLURAL WINS interacts with PROXIMITY but carries relatively more weight than the latter in determining German speakers' agreement preferences in declarative sentences of the kind we examined. The FIRST CONJUNCT WINS constraint cannot account for the observed gradient preference pattern, suggesting that it does not carry much weight.

Clearly though, constraints other than those discussed above also play a role in guiding speakers' agreement choices. The results of Experiment 1 show that the semantic type of conjunction can modulate German speakers' general plural agreement preference, for example. This finding indicates that the degree to which a complex subject can be conceived of as a plurality also needs to be factored into the picture (compare Smith et al. 2018). Whether the agreeing verb follows or precedes the subject phrase—a factor that we did not investigate here—may play a role as well.

Our results further suggest that models of agreement computation should also incorporate processing-related constraints. Recall that we observed task effects such that the type of conjunction only affected speakers' performance in Experiment 1, an offline metalinguistic task, but not in the presence of processing pressure. The absence of any semantic effects in Experiments 2 and 3 could be taken to indicate that semantic differences between correlative conjunctions are only taken into account during later, conscious stages of agreement computation but not initially or if processing resources are being taxed.

7. Concluding Remarks

Coordinated subjects have often been noted to allow for variable number agreement, with speakers' choices being affected by a range of factors only some of which could be considered here. Descriptive and theoretical approaches to correlative coordination have not usually been informed by systematically collected data, a situation which we hope our study will help improve. We further suggest that modelling variable subject–verb agreement within multiple-constraint frameworks is the most promising way of capturing variability and gradience. Possible directions for future study include investigating variable subject–verb agreement from a diachronic perspective (compare Dammel 2015) and exploring possible dialectal variation or inter-individual variability in this domain by testing larger participant samples. Using an experimental psycholinguistic approach to assess German speakers' agreement preferences with correlatively conjoined subjects, we found tentative evidence that the constraints under investigation might differ not only in their relative weighting but also in their relative timing. We hope that future research will follow up on our findings so as to obtain a more comprehensive picture of the constraints that determine variable agreement with conjoined subjects, and with the aim of better integrating theoretical and processing approaches to agreement computation.

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