Disjunction Junction:
Experimenting with *or*-coordination and verb agreement[1,2]
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1. Introduction

Subject-verb agreement in number is often straightforward. In sentences like *John is sick* or *John and Mary are tired*, it is uncontroversial in Standard American English that *is* and *are* are not interchangeable. In many cases, however, agreement becomes problematic. Morgan and Green (2005:458) note:

> ... the range of variation exhibited in verb agreement choices suggests that individuals' internal grammars for this basic phenomenon of language not only vary idiosyncratically, but may be incomplete or inconsistent.

This statement is based on evidence from a survey including several sentence types, representing non-standard word orders and subjects coordinated with both *and* and *or*. Morgan and Green further suggest that this inconsistency has far-ranging implications for the accuracy of theoretical models of grammar insofar as even recent versions of mainstream theories either ignore or claim agnosticism regarding problematic surface agreement facts: Agree (Chomsky 2000), for example, matches features between subject and verb, and although Agree operates on an abstract level, overt morphological markers of subject-verb agreement are taken to reflect the results of the Agree operation, assuming no interference between the syntactic and surface levels. However, if overt agreement morphology does not reflect the theoretical results of the Agree operation, it is commonly attributed to some unknown interference, and often dealt with no further.

The claim that verb agreement is idiosyncratic in cases with coordinated subjects, however, can conflate several factors. Many analyses of coordination agreement have treated conjunction as representative of both *and* and *or*-coordination: Morgan and Green

(2005), for example posit one set of principles to capture speaker's patterns for both. Haskell and Macdonald (2005), whose study represents one of the few analyses of disjunction and agreement in the literature, find that both Aoun, Benmamoun, and Sportiche's (1994) influential ellipsis analysis of first conjunct agreement and Munn's (1999, 2000) influential clausal analysis with adjunction fail to correctly account for disjunction data at a basic level. It is interesting, given previous work on coordination, that the majority of it has focused on conjunction. It is generally accepted that in all but special cases (First Conjunct Agreement, for example, or certain effects noted by Lorimor (2007)), conjoined subjects typically take plural agreement. Disjoint subjects, on the other hand, either exhibit a far weaker overall preference for plural verbs, as Haskell and Macdonald (2005)'s data indicate, or exhibit no significant overall preference for either verb number, as my own results in section 5 indicate. For this reason, disjunctive agreement provides a valuable source of information for the identification of fine-grained distinctions involving various syntactic and linear effects.

Determining the exact properties of coordination and agreement, then, is a thorny issue, and demands empirical coverage in terms of well-defined experimental study. Lorimor (2007) has investigated the properties and factors affecting conjunction (*and*-agreement) in detail through experimental psycholinguistic methods, but this work does not straightforwardly extend to the properties of disjunction (*or*-agreement), which, Lorimor writes, "are troublesome because of the difficulty in isolating the logical subject (whether the exclusive or inclusive "or" is used)" (18). This might overstate the difficulty of such an undertaking: *or* has no exclusive *meaning*, but only an exclusive *sense*, and this only arises in certain pragmatic conditions; otherwise, *or* operates as inclusive. Further discussion of this is found in section 2d.

Through an empirical study of grammaticality judgments on instances of verb agreement with disjunctive subjects, I evaluate Morgan and Green's (2005) claim that individual grammars are idiosyncratic and inconsistent with regard to coordinative agreement, and evaluate a range of possible strategies for agreement with a disjunctive subject. From the results of statistical tests of these strategies and their applications, I propose a tentative

analysis of agreement with disjunction which involves both syntactic structure and linear order. By allowing percolation of number features to the highest DP only in the case that both number features match, I am able to capture certain distinctions which arise from the data. Additionally, I argue that a complete account of the structure of coordinated subjects may require distinct structures for *and* and *or*, pending an analysis which can capture the relevant facts in both cases.

This paper is structured as follows: In Section 2, I discuss previous work on experimental design, studies of coordination and agreement, and the syntactic properties of coordination and agreement. I present my methodology in Section 3. Section 4 is a presentation of the results of descriptive and statistical analyses, and Section 5 discusses the theoretical implications of these results. I conclude and summarize my findings in Section 6, and in Section 7, suggest directions for further research.

2. Previous work

In the section that follows, I provide a justification for the study presented here as well as a background for the theoretical discussion to follow. I will begin with a set of criteria drawn from two sources for a reliable experimental study on syntax. I will then discuss previous work regarding coordination (including *and-* and *or-* coordination) and agreement and then discuss the syntactic and semantic properties of coordination and agreement. Finally, I will turn to more recent psycholinguistic experiments involving coordination and agreement which become critical to my own discussion.

2a. *Suggestions for proper experimental design*

Before discussing the previous work on coordination and agreement, it is worthwhile to consider what good experimental design would entail. For my own study, I draw suggestions from two sources: Carson T. Schütze's (1996) *The empirical base of linguistics* and Wayne Cowart's (1997) *Experimental syntax: Applying objective methods to sentence judgments.* I will begin with the principles offered by Schütze, who surveys

studies on experimental design in linguistics, and makes several suggestions to the researcher.

With regard to the selection of materials, Schütze suggests that the order of presentation be both randomized and counterbalanced such that each subject or group of subjects receives a different order of items. The semantic content and pragmatic context of the items is also important and should be kept constant, avoiding unnecessarily abstract or unimaginable concepts, as well as avoiding differing pragmatic contexts.

The selection of subjects is a second major factor. On this, Schütze writes:

> I would implore that these must be people with no linguistic training. If it is the competence of normal native speakers that we claim to be investigating, we need to study random samples of normal native speakers. This is almost never done by theoretical linguists…. They first consult their own intuitions (one cannot find a more biased subject than the investigator), then their colleagues in the next office (almost as biased), and if the are really ambitious, perhaps a couple of their students (not exactly objective either, since students likely know which result their professors are hoping for and would like to gain their favor) (1996: 186)

On instructing the subjects with regard to a judgment task, Schütze notes the importance of being clear and concise without being overly technical. In a grammaticality judgment task, Schütze mentions that the use of comparative judgments is favored by many researchers, but does not propose specific methods of determining the subjects' judgments, other than noting that forced-choice questionnaires (like those used in Morgan and Green (2005) below) often produce noisy, error-ridden data.

Cowart (1997) suggests a particular class of methods for obtaining judgments, and presents several studies involving well-known syntactic grammaticality distinctions, including subjacency violations and that-trace effects, which support the efficacy of these methods in reliably determining stable patterns of judgments within speech communities.

Cowart echoes Schütze's (1996) suggestions with regard to randomization and order of presentation as well as his suggestions on the selection of subjects. On the issue of instructions for the subjects, Cowart performs a brief experiment using identical

sentences with two sets of instructions: one which instructs subjects to use intuition in their judgments, and another which instructs subjects to behave prescriptively. The difference in response patterns was negligible, suggesting that instructions play little role in subject behavior. This even further underlines the necessity of reliable experimental design.

With regard to obtaining subjects' judgments, Cowart favors an approach which uses a grammaticality scale. The advantage to using a grammaticality scale (as opposed to a forced-choice or relative-judgment task) is that the results are not only numerical, but also interval, with the proper scale design. While ordinal data fall along an ordered scale, the distance in between points on the scale is not necessarily equivalent. With interval data, on the other hand, the distance is regular, making the data eligible for analysis through advanced statistical methods. In order to capture interval data, it is critical to define only the endpoints of the scale, indicating to the subject that the intermediate responses occur at regular intervals between these endpoints. For example, on a three-point grammaticality scale, with 3 labeled as 'perfectly acceptable' and 1 labeled as 'completely unacceptable', there is no clear way to ensure that any possible label for 2, e.g. 'marginally acceptable' or 'partially acceptable' will be conceptually equidistant from 3 and 1, in the mind of the subject.

With these suggestions for reliable experimental design in mind, I next discuss the previous literature on coordination and agreement.

2b. *Strategies for agreement*

In this section, I discuss three approaches which posit sets of principles, constraints, or strategies to describe patterns in data collected from forced-choice surveys.

As mentioned in the introduction to this paper, Jerry Morgan and Georgia Green's (2005) "Why verb agreement is not the poster child for any general formal principle" makes several interesting claims regarding speakers' individual grammars. In this chapter,

which is in many ways a continuation of Jerry Morgan's (1972a, 1972b, 1984) work on verb agreement in English, Morgan and Green argue against the assumption that subject-verb agreement is a 'core' principle of syntax, proposing a set of 5 ranked principles to account for subjects' agreement patterns. These principles are to be understood not as principles of the grammar, but rather as ad hoc inventions, as the ranking of each principle relative to the others was found to vary from subject to subject, yielding idiosyncratic results. Some subjects were additionally found to apply the principles inconsistently in repeated survey items.

Morgan and Green's survey was conducted in 1975, 30 years before the article was published. The authors do admit that the survey would not fulfill the rigorous psycholinguistic standards of 2005, and suggest that this study be considered a pilot—an expanded study with more rigorous methodology (including fillers, using non-linguist subjects, testing fewer variables) might make broader generalizations possible.

On the basis of the collected data, Morgan and Green (2005:464-5) propose the following five principles, which I paraphrase here—the first, however, is not applicable to disjunction.

> a. Logic of 'and' (LA)
>> Conjoined subjects always require a plural verb.
> b. Closest conjunct principle (CCP)
>> With a coordinate subject, the verb agrees with the closest conjunct. (ex. *There is a lawyer and two doctors in the room* but *There are two doctors and a lawyer in the room*)
> c. As if conjoined (AIC)
>> The grammatical person and number of a disjoint subject is computed as if it were conjoined. Seems to arise in cases of disjunct 1st and 2nd person subjects, and in disjunct 3rd person subjects only in non-affirmative cases. (ex. *Are John or I going to be admitted? Are either Harry's wife or his daughter at the party?*)
> d. Default (Def)
>> Subjects with non-transparent agreement properties have an invariant third person singular verb. Seems to be used in relative clauses modifying an accusative case pronoun and with coordinate

NPs containing an accusative case conjunct. (ex. *It's I who am your interpreter*, but *It's me who is your interpreter*.)

    e. Plural if Either is Plural (PIEP)

Coordinate subjects require a plural verb if either conjunct is plural. (ex. *Is a fly or a bee in the soup? Are a fly or two bees in the soup? Are two bees or a fly in the soup?*)

Through manipulation of subject-verb order, Morgan and Green found multiple distinct patterns for conditions with *and*-conjunction, *or*-disjunction, and *either...or*-disjunction. I will summarize here the findings on *or*-disjunction, which are the most relevant to the present study. Patterns found were not universal—the most common pattern, the use of PIEP with preverbal subjects, was found in 4 of the 12 subjects. Definiteness/indefiniteness of preverbal subjects further distinguished patterns, which alternated between AIC or CCP and PIEP or CCP. Exact numbers regarding the use of these patterns were not given, but it is clear that fewer than 4 of the 12 subjects used them. In light of their results, Morgan and Green once again challenge what they consider the everyday assumptions of the "ordinary working grammarian" with regard to the equivalency of adult grammars within a community, the consistency of successive judgments on identical items, and ability of speakers to judge the grammaticality of any given item. The authors continue this line of thought by favoring the theoretical option of unique, idiosyncratic grammars, which "enable enough of an illusion of mutual understanding to foster continued discourse with other members of the community" (2005: 468-469).

This may be a very attractive notion to any disaffected syntactician obstructed in his or her work by the inconsistency of native speaker judgments, but Morgan and Green's survey methods are, by their own admission, flawed. The survey instrument was too long for one session (judgment failure prevented many subjects from completing it), included no filler sentences, and was conducted among linguists. Additionally, the multiplicity of manipulated variables denied the researchers the possibility of analyzing data across subjects, allowing them to identify only distinct patterns within subjects: The study involved *and*-conjunction, *or*-disjunction, and *either...or*-disjunction in normal order, preverbal subject order, and *there*-sentence order, and included coordinated subjects which were conceptual units (*ham and eggs*), numerals (*35 bushels*), polar questions, and

a few non-copular verbs (*speak, open*). Additional variables included definiteness (*John* vs. *a lawyer*), animacy (*doctor* vs. *ice cream*), and person (*I* vs. *two lawyers*). Finally, there are significant disadvantages to the forced-choice completion task, in that it yields non-interval data, preventing advanced statistical analysis. In my own survey, I instead opt for a category scale corresponding to levels of grammaticality.

Morgan and Green (2005) pose important questions central to the study of formal linguistics, but the survey and analysis methods used mandate a re-examination of the reported results through further study.

Randall Eggert's (2002) dissertation "Disconcordance: The syntax, semantics and pragmatics of *or*-agreement" takes an Autolexical approach, which combines various language systems at once to achieve desired outcomes. Eggert carried out a relative judgment survey involving 184 sets of sentences, some of which involved conjunction, and some which involved disjunction. Each set of sentences contained two versions of the same sentence—one with singular agreement and one with plural agreement. 26 completed surveys were considered; these were filled out by undergraduate and graduate students of linguistics at the University of Chicago. In his analysis, Eggert took a generally qualitative approach, focusing on the constraints in use for subjects' agreement choices rather than on numerical results (2002:174). Eggert takes constraints to be "violable injunctions on aspects of languages" (170), which are weighted, rather than ranked, and may vary in relative weight from speaker to speaker. The constraints posited by Eggert to account for agreement choices are the following (2002:197, 215, 233, 234):

> Syntactic constraints:
>> FORMNUM: A verb should agree in grammatical number with its syntactic subject.
>> HIGHNUM: A verb should be plural if one of the NP heads in its syntactic subject is plural.
>> NEARNUM: A verb should agree in grammatical number with the nearest NP head of its syntactic subject.
>> FIRSTNUM: A verb should agree in grammatical number with the first NP head of its syntactic subject.
> Semantic/Pragmatic constraints:
>> SEMNUM1: A PRED1 should be marked for semantic number.

SEMNUM2: If the semantic number of a PRED1 is marked, it should have the same number as its semantic subject.

DRNUM: The sum of any two discourse referents should be a plural discourse referent.

MODELNUM: Where x is a discourse referent and $[[x]]$ is the assignment of x in model M, $|x|$ should be equal to $|[[x]]|$.

SEMNUM=FORMNUM: If a verb is marked for number in Syntax, the corresponding PRED1 should be marked for the same number in A/P.

Additional constraints:

DISNUM: If a PRED1 has a disjunctive ARG for subject, it should be unspecified for number.

MULTIJUNCT: A verb should be marked plural if its syntactic subject consists of more than two NP heads.

Eggert argues, critically, that coordinative NPs (conjunctive subjects and disjunctive subjects) are unmarked in number, apparently owing to the fact that such NPs are morphologically unmarked for number (196). The result of this is that FORMNUM simply does not apply in coordinate structures. In addition, NEARNUM and FIRSTNUM are not strictly syntactic, but appeal to Linearity (one of the language systems in use in the Autolexical approach) for definitions of 'nearest' and 'first'. The semantic and additional constraints are more complex, but seem to be posited for specific problematic cases, and are not the deciding factor in the majority of cases. The similarity to several of Morgan and Green's (2005) strategies is striking; NEARNUM seems to be generally equivalent to the CCP, and HIGHNUM likewise to PIEP. DRNUM would also yield similar results to Morgan and Green's AIC.

There are several problems regarding the methodology of the study. The subjects (as with Morgan and Green's and Peterson's, below) were linguistics students, and no mention is made of filler sentences. Further complicating analysis, the method of relative grammaticality judgments, which involves the display of two sentences identical in all but one element, leaves few questions as to the purpose of the experiment, especially in the absence of fillers. Some conjoined subjects were used as a control—perhaps assuming too much of the consistency of conjunction agreement in light of Lorimor's (2007) findings, but no error-checking was carried out. In addition, Eggert used different verbs and types of predicates: *get good grades* and *drive Loretta's car* (2002: 190) are some of the dissimilar examples given.

Eggert (2005) uses the findings from his study, the findings from Peterson's (1986) analysis (discussed below), and an appeal to reduced speaker and hearer burden to motivate his claims with regard to the syntactic and semantic constraints on agreement. He further argues that pragmatic effects are critical, and that speakers use world knowledge in certain cases to make agreement decisions. An important assumption in Eggert's account which will be relevant to the theoretical discussion of the present study is that number features in coordinated NPs may not percolate to the coordinating NP. This means that, syntactically, the verb cannot agree with the coordinated NP as a whole, and the only agreement with disjuncts occurs with the most linearly proximate carrier of the number feature.

Peterson's (1986) analysis of agreement with disjoint subjects makes use of the Lexical-Functional framework, which prevents NP number features from percolating to the coordinated NP, as in Eggert (2002). Semantics, then, takes over—Peterson refers to Morgan's (1972) concept of semantic or pragmatic strategies, "by which speakers can 'patch' or 'repair' gaps left by the grammar" (233). Peterson then posits the following strategies: PROX, (Morgan and Green's CCP, Eggert's NEARNUM), PLU WINS (Morgan and Green's PIEP, Eggert's HIGHNUM), FC WINS (Eggert's FIRSTNUM), and SG WINS (PLU WINS, but for singular—this strategy is discarded almost immediately). In a forced-choice survey with similar methodology to Morgan and Green (2005) survey (and subject to the same criticisms), Peterson reaches similar conclusions, with a caveat: While Morgan (1985) and Morgan and Green (2005) claim that these strategies are applied largely idiosyncratically, Peterson finds more systematic results, but maintains that these strategies are not syntactic, and are instead extragrammatical. Interestingly, Peterson also cites two examples of similar strategies being grammaticalized in Slovene and Albanian, noting that these would have to be stipulated at extra cost to the grammar" (1986:246). The first example is from Corbett (1983 (13))[3]:

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[3] These three examples are presented in the format used by Peterson (1986:246-7). For bibliographic references for these examples, refer to Peterson (1986).

(1) *groza   in strah   je prevzela   vso   vas*
    horror(fem) & fear(masc) has seized(fem sg) the whole village

This is proposed to exhibit the application of the "FIRST CONJUNCT principle"[4] as grammaticalized in Slovene. The next two examples Peterson presents are from Morgan (1984), and are proposed to exhibit the grammaticalization of agreement with closest conjunct:

(2) *djali   dhe   vajza   e/*i/*ie   kryetarit*
    son(NOM) &   daughter(NOM)   PART (f.sg/*m.sg/*pl)   of the president

(3) *djali   dhe vajza   i/*e/*ie   kryetarit*
    daughter(NOM) &   son(NOM)   PART (f.sg/*m.sg/*pl) of the president

All three of these examples involve conjunction, rather than disjunction, and only Morgan's involves number agreement. The common, and possibly misguided, conflation of conjunction and disjunction is discussed in my introduction, and the first conjunct agreement shown in (1) can easily be accounted for in a syntactic account of conjunction which hierarchically privileges one conjunct over the other (e.g. Munn (2000)). (2) and (3) exhibit closest conjunct agreement, which is an effect noted by Lorimor (2007) and which is most relevant for the present study.

The three studies discussed in this section represent different frameworks, but importantly, all converge on one critical issue—it seems that the grammaticality of agreement with disjoint subjects is problematic and possibly gradient, and it is natural, given the data presented, to view these facts as the result of a conspiracy of principles, strategies, or constraints. This convergence suggests the utility of categorizing judgments in this manner. However, while descriptively adequate, the identification of these strategies is only the first step—a true account requires an explanation for the distribution of the strategies. Additionally, the experimental techniques used in these three studies

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[4] Throughout his paper, Peterson variously refers to the strategy of agreement with the first conjunct/disjunct as FC WINS, FIRST CONJ, and FIRST CONJUNCT. No clarification is offered, and I assume these three to be equivalent terms.

can be improved upon. The application of reliable experimental techniques as outlined in section 2a is discussed in section 3 and implemented in the present study.

2c. *The syntactic structure of coordination*

Over the last fifteen years, there has been significant discussion with regard to the structure of coordinated subjects within Chomskian frameworks. Aoun, Benmamoun, and Sportiche (1994, 1999) and Munn (1999, 2000) represent two major lines of thought on the issue.

ABS (1994) argue for a clausal analysis of first conjunct agreement. Data from Moroccan and Lebanese Arabic support coordination at the clausal level: In VS sentence order, cases of singular verb agreement with singular first conjuncts are grammatical, but the distribution of additional elements (number-sensitive items requiring plural antecedents) like *bžužhum* (Moroccan Arabic, 'together') seems to indicate that the conjoined subject is not plural. This leads ABS (1994) to treat instances of singular verb agreement with singular conjuncts as clausal coordination, and instances of plural verb agreement with singular conjuncts as phrasal DP coordination. ABS (1999) defend this analysis as using only the existing mechanisms of right-node raising and across-the-board (ATB) extraction.

Lorimor (2007), however, finds that in Lebanese Arabic, adjectival agreement with singular coordinated subjects is plural, and that in VS order, singular first conjunct agreement can occur along with plural adjectival agreement, indicating that the conjoined elements are phrases, rather than clauses, thereby ruling out ABS' clausal analysis of first conjunct agreement. In terms of disjunction, Haskell and Macdonald (2005) consider an ellipsis analysis like ABS' an unlikely account of their results: operating in the SV and VS orders, the ellipsis analysis would have to elide the first predicate in one order, and the second predicate in the other, and would eventually be forced to appeal to linear proximity. Lorimor (2007) and Haskell and Macdonald (2005) are discussed further in section 2e.

Munn (1999, 2000) proposes an analysis of coordination in which the conjuncts are phrases; under Munn's analysis, a Boolean phrase (BP) is adjoined to the first conjunct as follows in (4):

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                        DP
                   ┌────┴────┐
(4)               DP         BP
                        ┌─────┴─────┐
                        B           DP
                      and/or            (2000:2)
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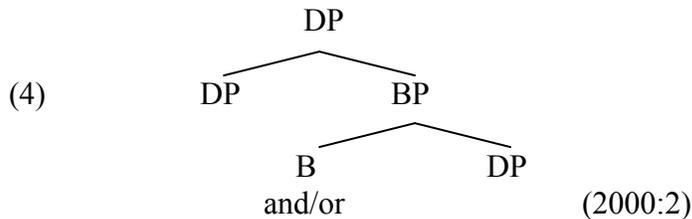
Munn provides several motivations for this structure: the most relevant here is what he calls the first/second conjunct asymmetry. Munn writes:

> Descriptively, many languages permit agreement with a single conjunct in certain syntactic configurations. In head initial languages … it is the first conjunct that triggers agreement. (2000:2)

When the option of first conjunct agreement is available, as in ABS' examples, either the mother DP or the highest conjunct DP can trigger agreement through government or exceptional government, respectively—the verb governs the mother DP under the standard definition of government, and, by extension, the highest conjunct DP, provided some sort of transparency exists. I illustrate this in (5), below, where V governs DP1 and exceptionally governs DP2, with the latter type of government allowing first conjunct agreement.

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              ┌──────┴──────┐
              V            DP1
                       ┌────┴────┐
(5)                   DP2        BP
                            ┌─────┴─────┐
                            B           DP3
                          and/or            (2000:2)
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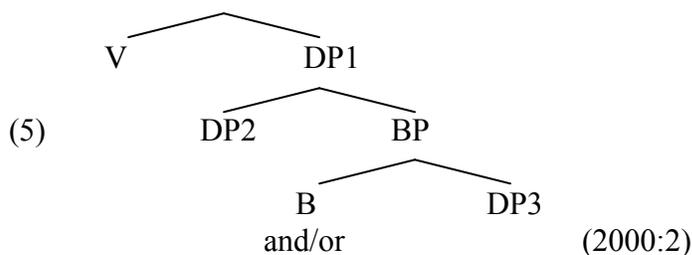
It seems to be assumed (implicitly in the notion of the Boolean phrase and explicitly in Munn's diagram reproduced in (4)) that this analysis extends straightforwardly to disjunction. Every example provided by Munn (1999) and Munn (2000) to support this analysis involves conjunction, and the results of experimental study indeed confirm the feasibility of this analysis for conjunction: Lorimor (2007) notes that this analysis of

coordinate structure correctly predicts her experimental findings. Haskell and Macdonald (2005), however, evaluate Munn's analysis in terms of disjunction data, and find that it fails to account for their results: the preference found by Haskell and Macdonald for agreement with a linearly proximate element in both VS and SV sentence orders suggest that in the case of disjunction, a hierarchical account does not reflect this asymmetry.

2d. *The inclusive vs. the exclusive 'or'*

Lorimor (2007) suggests, as noted in the introduction to this paper, that the possibility of subjects interpreting 'or' as inclusive or exclusive could confound the experimental testing of agreement with disjunctive subjects. In this section, I briefly explain why this problem is not as severe as it might first seem.

In "The myth of the exclusive 'or'", Barrett and Stemmer (1971) explore what they believe to be a common misconception, namely that a purely truth-functional exclusive 'or' exists in English. They are careful to note that an exclusive *sense* of 'or' does exist in English, but this sense only arises a) when the disjoined items are logically incompatible, or b) under certain contexts (i.e., is pragmatically conditioned). As examples, they consider (6) to be of the first type, and (7) to be of the second.

> (6) It is raining or it is not raining
> (Barrett and Stemmer 1971:117)
>
> (7) (in the context of options on a restaurant menu) Tea or milk.
> (Barrett and Stemmer 1971:118)

So, if these express two types of exclusive senses which exist in the English language, then designing a survey which negates the possibility of logical incompatibility should not be difficult. In the survey described in sections 3-5, I use sentences like the following:

> (8) There is an orange or a shoe in the box.

It is immediately obvious that the disjoint conditions are not logically incompatible. If, on the other hand, some other context is given, e.g. "That box is only large enough to

hold one item," this would represent a pragmatically conditioned exclusive sense of *or*. If no such context is given, I argue that it is natural to interpret (8) as the default truth-conditional inclusive reading.

The present study does not test the possible effects of an inclusive vs. exclusive reading of *or*, as constructing non-repetitive but equivalent contexts for each experimental item (and filler) would have been unfeasible. Whether an exclusive reading of 'or' would predict more singular verb agreement remains to be tested, but Lorimor's (2007) claim regarding disjunction does not seem to be entirely accurate: the statistically significant and explicable findings in Haskell and Macdonald's (2005) study (which did not involve manipulation of context) suggest that the possible exclusivity of *or* does not impede the collection of valid results.

2e. *Experimental accounts of coordination involving advanced psycholinguistic methods*

Heidi Lorimor's (2007) dissertation, "Conjunctions and Grammatical Agreement", represents a thorough survey of the literature on agreement with conjoined subjects, and presents the results from a battery of Lorimor's experimental studies in English and Lebanese Arabic. The methodologies used in these studies are too detailed to reproduce here, but it suffices to note that these studies involved reliable psycholinguistic methodology as per the recommendations listed in section 2a of this paper. Lorimor's results describe four major types of effects on agreement with conjunctions:

1) Both singular and plural agreement were found to occur with conjoined subjects, with singular agreement being more common with singular conjuncts.

2) Word order was also found to play a significant role, and targets following the agreement controller were found to be more likely to display full agreement.

3) Linear proximity plays a role as well: plural conjuncts occurring near to the verb made plural verb agreement more common.

4) Various semantic effects stemming from the noun type were also found to affect agreement; these include animacy, definiteness, notional number, and others.

As noted in the introduction, Lorimor (2007) does not engage the issue of agreement with disjoint subjects, and comments that the results of her analyses would not necessarily be expected to extend to disjunction, which she claims is difficult to test experimentally (but see section 2d for a counter-argument).

Haskell and Macdonald (2005) carry out a series of experiments focusing on agreement with disjunctive subjects. Their primary interest is in using the information involved in computing agreement to argue for a single-stage analysis of hierarchical structuring and linear ordering: if both kinds of information are used in computing agreement, claim the authors, then both processes must occupy the same stage in production. To this end, they carried out three experiments: a carefully-controlled reproduction of Peterson's (1986) forced-choice experiment along with two elicitation tasks involving card sorting , with each experiment eliciting a different sentence order. Examples of the types of sentences elicited in the second and third experiments are below:

> (9) Can you tell me whether the horses or the clock is/are red? (2005:895)

> (10) Is/Are the horses or the clock red? (2005:896)

In the production experiments, Haskell and Macdonald elicited disjunctive subjects with singular-singular, plural-singular, singular-plural, and plural-plural disjunct orders, but their analysis was performed only on the plural-singular and singular-plural orders. They found a significant overall preference for agreement with the closest disjunct in all three experiments. The manipulation of sentence order revealed that the effect under consideration was indeed a linear proximity effect, rather than a hierarchical order effect—while in SV condition, the results found a preference for agreement with the second noun, VS order resulted in a preference for agreement with the first. Each of these preferences reflects agreement with the closest noun to the verb.

Several interesting asymmetries were found in Haskell and Macdonald's data: first, they found that in both the forced-choice online production experiments with SV order, the preference for closest agreement was more frequent in the Singular-Plural condition (that is, when the agreeing disjunct was singular) than in the Plural-Singular condition. In the

forced-choice Plural-Singular condition, in fact, "there was a slight numerical preference for agreement with the more distant noun." (2005:894)—a surprising result, to say the least. Another asymmetry was found between the SV and VS sentence orders: The proportion of agreement with the closest disjunct was lower in SV order when the closest disjunct was singular than when the closest disjunct was plural. In the VS order, regardless of whether the closest disjunct was singular or plural, closest disjunct agreement occurred reliably.

In discussing these results, Haskell and Macdonald (2005), using terminology from MacWhinney and Bates (1985), propose that linear order can serve as a type of cue for accuracy in agreement processing, and that its usefulness as a cue is tied directly to its *availability* (how accessible it is as a source of information) and its *reliability* (how often it comes to the right answer). Linear order is always available; words on the surface always occur in a certain order (for an individual instance of a sentence). In order to determine the reliability of linear order, Haskell and Macdonald conducted several tests on selections from the Brown corpus of written text. In brief, these tests demonstrated that linear order is, in fact, a reliable predictor of the agreement controller. In addition, a test of sentences with either two nouns preceding or two nouns following the main verb demonstrated that, in SV order, agreement with the closest noun in Plural-Singular noun order is a significantly worse predictor of the agreement controller than it is with Singular-Plural noun order. This closely follows the pattern of their SP-PS asymmetry, suggesting that speakers may partially rely on distributional facts.

3. Methodology

The present study was carried out with Schütze's (1996) and Cowart's (1997) recommendations for a well-executed empirical study in mind, although not every suggestion was feasible to implement.

3a. *Survey format*

A two-part web-based survey was conducted using UIUC's Webtools interface[5]. Twelve subjects were recruited through online forums and UIUC e-mail listservs to participate, but only seven completed both surveys. Participation involved verification of affiliation through use of the UIUC NetID. Demographic information was collected before survey questions began: four subjects were female and three male. Subjects were all native speakers of American English; In order to identify dialectal influences, subjects were asked for US cities and states where they had lived for 5 years or more. 5 subjects reported only locations in Illinois, one reported Florida, and one Wisconsin. Subjects were non-linguists.

A category scale of grammaticality judgments was used: Subjects were asked to indicate the grammaticality of the given sentence with the numbers 1, 2, 3, and 4, with 4 indicating a 'fully normal and understandable' sentence, and 1 indicating an 'odd, awkward, or difficult sentence.' In order to provide a true category scale in which intervals are equal, 2 and 3 were left undefined, other than that they indicated regularly spaced levels in between the endpoints. In addition, the subjects were asked to set aside classroom grammar rules and to imagine the sentence being spoken in a casual conversation.

Morgan and Green (2005) noted that judgment fatigue set in early in their survey, and a number of their subjects were unable to complete the survey for this reason. One of the suggestions given for further research was to administer the survey in phases. In order to combat judgment fatigue in the present survey, subjects were instructed to take a break and pursue another activity for a short time if they felt unable to judge sentences accurately at some point in the survey. Additionally, the entire survey was broken into two parts separated by at least a week's time to further avoid judgment fatigue.

The first section of the survey was 154 items in length. The first ten items were intended for calibration, and ranged from well-known grammatical formations to severe violations

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[5] http://webtools.uiuc.edu

of basic syntactic principles, intended to acclimate subjects to the survey and determine whether the grammaticality rating system was correctly understood. The remaining 144 items consisted of fillers and experimental items. These were blocked and pseudo-randomized (randomized, and then re-arranged so that no more than two experimental items occurred in a row) according to Cowart's (1997) recommendations. 50% of the given sentences were fillers, with half of these being generally grammatical and the other half generally ungrammatical. The remaining 72 were experimental items.

The second section of the survey was 164 items in length. Again, the first ten were calibration questions, and the next 144 were pseudo-randomized fillers and experimental items. The final ten items were repeat experimental items from the first survey, intended to test for consistency between surveys. In both sections, a notes field was provided below each sentence in case the subject wanted to provide an explanation of their decision.

3b. *Construction of survey materials*

In constructing survey materials, several pitfalls were avoided. The number of variables was constrained and relevant to the purposes of the study: *or*-disjunction is the only coordination under scrutiny here, and sentence order and disjunct plurality were manipulated in order to achieve agreement instability effects similar to those found in Morgan and Green's (2005) and Lorimor's (2007) studies. The third variable, alternation of *is* and *are* in verb position, is crucial to the discovery of agreement effects, which lie at the heart of this analysis.

All other relevant factors were kept constant when possible. Both coordinated DPs used were inanimate, due to the animacy effects on conjunction noted by Lorimor (2007), and both were in the third person. Definiteness was also kept constant; determiners used were *a* and *some*. *Some* was chosen instead of *two* or *three* because of the known effects of numerals on agreement (Morgan and Green 2005: 457). The sentential subjects were additonally chosen to avoid frequent collocations or conceptualization as a unit (like *ham, eggs*; *ball, chain*). In order to keep the situations imaginable, common, concrete objects

were chosen. A prepositional predicate such as *in the next room* was chosen because of the possible indeterminacy of an object or objects 'somewhere else'.

The experimental items were comprised of 24 distinct conditions. Three sentence orders were used: 1) normal sentence order (SV), 2) pre-posed predicate order (VS), and 3) *there*-constructions.

> 1) A statue or a chalkboard is in the next room.
> 2) In the next room is a statue or a chalkboard.
> 3) There is a statue or a chalkboard in the next room.

Disjunct plurality involved four possible values: a) singular-singular, b) singular-plural, c) plural-singular, and d) plural-plural.

> a) A statue or a chalkboard is in the next room.
> b) A statue or some chalkboards is in the next room.
> c) Some statues or a chalkboard is in the next room.
> d) Some statues or some chalkboards is in the next room.

Verb agreement was also manipulated between forms of the copula.

> 1) A statue or a chalkboard is in the next room.
> 2) A statue or a chalkboard are in the next room.

Six different sets of sentence 'ingredients' (i.e. NPs and prepositional predicates) were also used for each condition, but these were used for variety and are not considered a variable:

> a) statue, chalkboard, in the next room
> b) orange, shoe, inside the basket
> c) newspaper, trashcan, in the hallway
> d) pen, bottle, on that table
> e) toothbrush, phonebook, in the box
> f) fountain, staircase, behind that door

This yields a total of 144 experimental items. The 144 fillers were created by adjusting the syntax of six other base sentences into multiple variations, roughly half grammatical and half ungrammatical. Each experimental item had a unique label concatenated according to the variable schema above: S1a1a was an experimental item (S), normal word order (1), with two singular disjuncts (a), singular agreement (1), and involved the first set of 'ingredients' (a).

3c. *Analysis*

The data were collected in .csv (comma-separated values) format and un-randomized. Each user's judgments on each condition were averaged (arithmetic mean). These averages were used as the basis for statistical analysis through the use of paired t-tests for means in Microsoft Excel and multiple-factor ANOVAs with repeated measures in SPSS.

One unexpected problem which arose during analysis is that one condition (meant to be VS order, first disjunct plural, second disjunct singular, plural agreement) was mistakenly left identical to the previous condition with singular agreement (VS order, first disjunct <u>singular</u>, second disjunct <u>plural</u>, plural agreement) in the master sentence list. Because this error was not discovered until after the data collection, nothing could be done and these data were excluded. This error will be corrected upon expansion of the study.

4. Results

4a. *Consistency and preference*

I begin with an evaluation of Morgan and Green's (2006) claim that "individuals' internal grammars for this basic phenomenon of language [verb agreement] not only vary idiosyncratically, but may be incomplete or inconsistent." I do not purport to be able to evaluate this claim in its entirety in the present study, but because much of Morgan and Green's support for this claim comes from the analysis of data on disjunctive agreement, the present study is relevant.

Ten items were chosen from the first part of the survey to reappear in the second part as a test of consistency. These were added to the end of the second survey; while distributing them throughout the text might have been preferable, this would have complicated the re-sorting/un-randomization of the items. The ten items were chosen from the first part of the survey on the grounds that these items seemed to display a great deal of inter-subject disagreement, and were therefore those most likely to exhibit inconsistency. The following table lists the number of inconsistencies for each subject and how far off the inconsistencies were:

	Inconsistencies (out of 10 possible per subject)	Original judgment +1	Original judgment -1	Original judgment -2	Original Judgment -3
Subject 1	1	--	--	--	1
Subject 2	4	--	3	1	--
Subject 3	**10**	**--**	**7**	**3**	**--**
Subject 4	6	4	2	--	--
Subject 5	2	1	1	--	--
Subject 6	3	1	--	2	--
Subject 7	0	--	--	--	--
Totals	26	6	13	6	1

Table 1. Inconsistencies in 10 repeated survey items.

In the majority (20/26) of inconsistent judgments, the second judgment was lower than the first. In addition, for subject 3 (shown in bold in table 1), who was not consistent once out of the 10 questions, the scale appears to have somehow shifted downward. In combination with the generally low changes in value, this suggests slight instability in judgment rather than random error[6].

In the analysis section, I noted that an error was made in preparing the sentences, leaving the sentences in one condition identical to those in another. While unfortunate, this error created an opportunity for further consistency checking: these six sentences were repeated, randomized with the rest of the materials, and were selected by accident, rather than through a process of singling out sentences which seemed likely to be inconsistent. The following table lists the number of inconsistencies for each subject in these items, as well as the change in value of each (direction of change is not given due to the difficulty of determining which sentence appeared first after the results were sorted):

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[6] By way of clarification: 'random error' here refers to an error in marking one's judgment in the survey instrument (e.g. clicking on the wrong button). It is presumed that a native speaker would not make errors in judging the grammaticality of sentences in his/her language.

	Inconsistencies (out of 6)	Different by 1	Different by 2
Subject 1	0	--	--
Subject 2	3	3	--
Subject 3	1	1	--
Subject 4	4	4	--
Subject 5	2	--	2
Subject 6	1	1	--
Subject 7	0	--	--
Totals	11	9	2

Table 2. Inconsistencies in 6 repeated survey items.

By way of addressing Morgan and Green's (2006) claim about consistency with these results, it does appear that individuals are to some extent inconsistent. The consistency data, it should be noted, is not simply random, as would be expected if these inconsistencies were errors in the use of the survey instrument. Subjects 1 and 7 seem to be rarely inconsistent: these subjects may have better-defined strategies in place.

In response to the other part of Morgan and Green's claim, that individuals vary idiosyncratically in their internal grammars, it seems relevant to test whether there was a preference for either singular or plural agreement with each condition. Paired t-tests were carried out on each pair of experimental conditions varying only on verb agreement in number, e.g. the contrast between *A statue and a chalkboard is in the next room* and *A statue and a chalkboard are in the next room*. Out of eleven pairs of conditions (the missing data and its partner condition were excluded), the preference for one type of agreement over the other was statistically significant in ten. The condition in which no significant agreement preference was found was canonical SV order with mixed disjunct plurality (singular closest). An example of the two conditions:

> (9a). Some oranges or a shoe is in the box.
> (9b). Some oranges or a shoe are in the box.

As the lack of statistical significance between the two conditions implies, average grammaticality ratings for these conditions were quite similar: singular agreement had an average rating of 2.76, and plural an average rating of 2.88.

Overall, subjects did show statistically significant preferences for one type of agreement over the other for each pair of conditions. This requires a large degree of unanimity, which suggests that in the case of disjunctive agreement, while individual users may be inconsistent to a certain degree, they are not as idiosyncratic as Morgan and Green's (2006) study suggests.

4b. *Descriptive statistics: Agreement with the closest disjunct*

In discussing the following results, it is important to distinguish between agreement strategies which rely on hierarchical structure and agreement strategies which rely on linearity: agreement strategies which rely on hierarchical structure involve claims regarding the syntactic structure of the coordinated DP (cf. Munn's (2000) analysis). Agreement strategies which rely on linear proximity are manifested through linear order at the surface level. On the basis of the previous literature, I take the following to be possible effects on agreement with disjunctive subjects:

Structural effects:
- Agreement with first disjunct (First)
- Agreement with last disjunct (Last)

Linearity effects:
- Agreement with closest disjunct (Closest)
- Agreement with furthest disjunct (Furthest)

Other effects:
- Agreement with both disjuncts additively (Both)
- Agreement with a default singular subject (Default)

Several points must be noted here with regard to the conditions tested: In SV order, First is equivalent to Furthest and Last to Closest, while in VS or expletive order, First is equivalent to Closest and Last to Furthest. For the current study, I focus on VS and expletive sentence orders, remaining agnostic with regard to whether these agreement strategies are structure-based or linearity-based; due to the preponderance of evidence for Closest agreement with coordinative subjects in the literature, I will use the linearity-based labels Closest and Furthest in this analysis.

Using the grammaticality judgments from the survey (a scale from 1 to 4), several important indicators arise through the use of simple descriptive statistics. Averaging all subjects' judgments on conditions with the canonical SV order, the average acceptability (arithmetic mean) of each of the following types of disjoint agreement are shown in the following table:

	singular disjuncts	mixed (closest singular)	mixed (closest plural)	plural disjuncts	average over all conditions
Singular agreement	3.81	2.76	2.09	1.50	2.54
Plural agreement	2.31	2.88	3.52	3.50	3.05

Table 3. Average judgments of all subjects in SV sentence order

We can contrast this with the same judgments from the other two sentence orders: VS and expletive orders show a similar pattern of agreement. The difference from the values in table 1 for each judgment are given in parentheses.

	singular disjuncts	mixed (closest singular)	mixed (closest plural)	plural disjuncts	average over all conditions
Singular agreement	3.93 (+.12)	3.46 (+.70)	2.25 (+.16)	1.76 (+.26)	2.85 (+.31)
Plural agreement	1.64 (-.67)	2.06 (-.82)	3.50* (-.02)	3.61 (+.11)	2.70 (-.35)
* Represents data from expletive condition only					

Table 4. Average judgments of all subjects in VS and expletive sentence orders

Major changes (over .50) are: an increase (+.70) in the acceptability of closest disjunct agreement with a singular disjunct; a decrease (-.67) in the acceptability of plural agreement with singular disjuncts (a situation in which the only way to justify such agreement is by agreement with both additively); and a marked decrease (-.82) in the acceptability of furthest disjunct agreement with a plural disjunct. Overall, there is a strong preference for plural agreement in SV order, and a weaker preference for singular agreement in VS and expletive orders. Because the Both strategy is possible only (and always) when verb agreement is plural, this suggests the greater influence of this strategy

in SV order. I refrain from making further claims regarding SV order, and instead turn to the VS and expletive sentence orders, in which agreement has previously been claimed to become unstable.

To clarify which situations occur in VS and expletive orders, and to see further patterns emerging from description of the data, I present the following table, which lists the possible strategies used for each condition, and graph, which displays the jump in acceptability noted in the table:

Average judgments over VS and expletive sentence types: 84 tokens per condition Ranked in order of decreasing acceptability		
Condition	Possible agreement with:	Average judgment (1.00-4.00)
1). Singular disjuncts, singular agreement	Closest Furthest Default	3.93
2). Plural disjuncts, plural agreement	Closest Furthest Both	3.61
3). Mixed disjuncts (plural closest), plural agreement	Closest Both	3.50*
4). Mixed disjuncts (singular closest), singular agreement	Closest Default	3.46
5). Mixed disjuncts (singular closest), plural agreement	Furthest Both	2.25
6). Mixed disjuncts (plural closest), singular agreement	Furthest Default	2.06
7). Singular disjuncts, plural agreement	Both	1.76
8). Plural disjuncts, singular agreement	Default	1.64
* Data from expletive sentence order only, 42 tokens		

Table 5. Ranking of average judgments on VS and expletive conditions, displaying possible strategies.
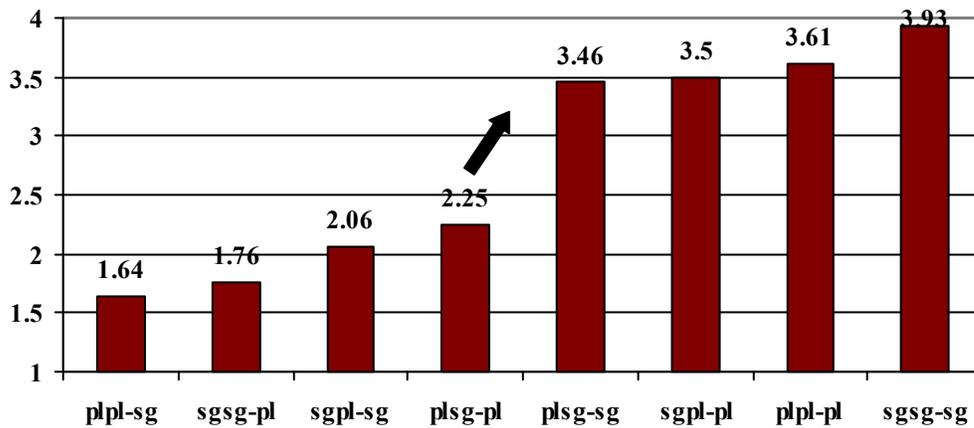
Figure 1. Display of the 'jump' in acceptability.

This jump in acceptability effectively splits the conditions into two groups: the four conditions on the right involve the possibility of agreement with the closest disjunct. Those on the left do not; descriptive methods alone strongly suggest that closest disjunct agreement is a valid and active strategy in VS and expletive sentence orders.

While the above data do not involve measures of significance, they do suggest directions for advanced statistical methods: Along with the importance of Closest, table 5 suggests that the addition of the Furthest agreement strategy improves acceptability. This occurs in all contrasts where the only difference in available strategies is the addition of possible furthest disjunct agreement. Additionally, three of four contrasting conditions which vary in terms of Both/Default strategies rate Both more highly than Default. The significance, if any, of such contrasts requires more advanced statistical methods.

4c. *Investigation via ANOVA*

To investigate the effects of these factors and possible interactions between them, a 3-factor within-subjects repeated-measures ANOVA was performed, including Furthest, Closest, and Number (Number agreement on the verb) as factors. Conditions where the Both strategy is used are equivalent to those with plural verb agreement, and likewise for the Default strategy and singular verb agreement. This ANOVA was carried out on data

from the expletive sentence order conditions only, due to the missing data in the SV order conditions. In all cases, the alpha level for significance was set at p<.05

Factor	Result (signif. = p < .05)
Furthest	F(1, 6) = 5.406, **p < .059**
Closest	F(1, 6) = 56.105, **p < .000***
Number	F(1, 6) = 1.551, p < .259
Furthest * Closest	F(1, 6) = .415, p < .543
Furthest * Number	F(1, 6) = 5.435, **p < .059**
Closest * Number	F(1, 6) = .380, p < .560
Furthest * Closest * Number	F(1, 6) = 2.953, p < .137

* indicates p <.05

Table 6. Results of ANOVA on Furthest, Closest, and Number, expletive sentence order

As expected, the effects of Closest are highly significant alone, confirming this as a reliable strategy. Furthest alone, as well as the interaction effects of Furthest * Number, approach, but do not achieve, significance. The near-significance of Furthest alone indicates that the distinction sentences exhibiting Furthest and sentences not exhibiting Furthest is a reliable one, suggesting that it is an active strategy. If the Number effect were significant, it would indicate that there is a reliable difference in grammaticality between singular and plural verb agreement, further supporting the idea that either the Both or the Default strategy outperforms the other. The fact that Number is not significant suggests that either these strategies do not exist in expletive-order disjunctive agreement, or that their effects offset one another. The interaction effect between Furthest and Number indicates that the effect of Furthest in items with singular verb agreement is different from its effect in items with plural agreement.

In order to determine whether the Furthest * Number interaction was due to singular or plural verb agreement, two separate 2-factor within-subjects ANOVAs were performed, each involving factors of Furthest and Closest, keeping verb agreement in number constant for each: table 7 presents effects under singular verb agreement, and table 8 refers presents effects under plural verb agreement.

Factor	Result (signif. = p < .05)
Furthest	**F(1, 6) = 9.047, p < .024***
Closest	**F(1, 6) = 22.136, p < .003***
Furthest * Closest	F(1, 6) = .364, p < .569

Table 7. Results of ANOVA on Furthest and Closest with singular verb agreement, expletive sentence order.

Factor	Result (signif. = p < .05)
Furthest	F(1, 6) = 9.047, p < .182
Closest	**F(1, 6) = 123.205, p < .000**
Furthest * Closest	F(1, 6) = 3.068, p < .130

Table 8. Results of ANOVA on Furthest and Closest with plural verb agreement, expletive sentence order.

The effects of Furthest as a strategy were found to be significant only under singular verb agreement. Additional data, however, is needed in order to confirm or deny Furthest as a strategy which operates in both singular and plural sentence orders.

To further determine the effects of the Furthest strategy, two more 2-factor repeated-measures ANOVAs were performed, one in the four conditions where Closest is present (table 9), and one in the four conditions where Closest is absent (table 10). As Closest was shown to have significant effects over all conditions, neutralizing it in this manner was expected to provide additional evidence for or against the existence of Furthest.

Factor	Result (signif. = p < .05)
Furthest	F(1, 6) = 3.605, p < .106
Number	F(1, 6) = .216, p < .658
Furthest * Number	**F(1, 6) = 5.542, p < .057**

Table 9. Results of ANOVA on Furthest and Number
when Closest disjunct agreement is present, expletive sentence order.

Factor	Result (signif. = p < .05)
Furthest	**F(1, 6) = 5.683, p < .054**
Number	F(1, 6) = 1.212, p < .313
Furthest * Number	F(1, 6) = .028, p < .873

Table 10. Results of ANOVA on Furthest and Number
when Closest disjunct agreement is not present, expletive sentence order.

Although statistical significance is not reached, several factors are marginally significant: when closest disjunct agreement is present, the interaction between Furthest and Number

factors (explored in tables 7 and 8 and discussed above) is marginally significant, and when closest disjunct agreement is not present, the effect of Furthest alone is marginally significant as well. This provides another piece of evidence for the existence of Furthest as a strategy.

4d. *Investigation via paired t-tests*

To identify the specific instances in which the effects of the proposed strategy of furthest disjunct agreement were significant, each pair of conditions differing only in the addition of the Furthest strategy were compared using a paired t-test for means. I have included an example sentence with each condition compared.

Comparison	Possible agreement with:	Average judgment	Significance (p<.05, two-tailed)
Singular disjuncts, singular agreement *There is a newspaper or a trashcan in the hallway.*	Closest, Furthest, Default	3.98	**.014**
Mixed disjuncts (singular closest), singular agreement *There is a newspaper or some trashcans in the hallway.*	Closest, Default	3.31	
Plural disjuncts, plural agreement *There are some newspapers or some trashcans in the hallway.*	Closest, Furthest, Both	3.64	.626
Mixed disjuncts (plural closest), plural agreement *There are some newspapers or a trashcan in the hallway.*	Closest, Both	3.50	
Mixed disjuncts (singular closest), plural agreement *There are a newspaper or some trashcans in the hallway.*	Furthest, Both	2.00	**.036**
Singular disjuncts, plural agreement *There are a newspaper or a trashcan in the hallway.*	Both	1.50	
Mixed disjuncts (plural closest), singular agreement *There is some newspapers or a trashcan in the hallway.*	Furthest, Default	2.26	**.091**
Plural disjuncts, singular agreement *There is some newspapers or some trashcans in the hallway.*	Default	1.74	

Table 11. Results of paired t-test for means, p<.05, expletive sentence order, comparing instances with and without agreement with furthest disjunct.

Regarding the results of these t-tests, two points should be noted: 1) two of the four comparisons under expletive sentence order were found to be significant, and another came close; and 2) in every case, the descriptive statistics move in a positive direction with the addition of Furthest as a possible strategy.

By way of summarizing the findings with regard to Furthest, the results of multiple statistical analyses give strong suggestions of its availability as a strategy, although it is not found to be statistically significant in most cases. It is likely that the lack of statistical significance could be an artifact of the small number of subjects who participated in the study. An expansion of this study with additional subjects would therefore be able to more solidly evaluate the existence of this strategy.

The remaining two strategies, Default and Both, are mutually exclusive, and pattern exactly with singular and plural agreement. In addition, either one strategy or the other is always present. It is impossible to compare conditions where one strategy is present to equivalent instances where it is not present, but it is possible to compare conditions where one is present to conditions where the other is present and all other factors are equal. Such a comparison of conditions was carried out through means of paired t-tests, and none of the comparisons were found to be significant. This, along with the results of the Number factor in the 3-factor ANOVA, suggests that if Default or Both or both are strategies, neither is especially influential in determining verb agreement. This observation extends to any other conceivable strategies which pattern exactly with singular or plural.

5. Theoretical implications

5a. *Choosing Closest over First*

The overall results of this study indicate that Closest is the most important strategy in use, and a conspiracy of test results additionally suggested that Furthest may be a factor. While I previously claimed agnosticism on the First-Last/Closest-Furthest issue of hierarchical vs. linear order effects, a return to Haskell and Macdonald's (2005) experimental study on agreement with disjunctive subjects is warranted: Haskell and Macdonald conducted several experiments with experimental and analytical methods well-known to be reliable. Additionally, while their particular interpretation of their results may have aligned with personal biases, their reporting of closest conjunct agreement as reliant on linear order over hierarchical order does not reflect a personal preference for any theory. The results of their manipulation of SV and VS sentence

orders, assuming that these results were reported accurately, simply show that their subjects had a preference for agreement with the linearly proximate disjunct regardless of possible hierarchical order. For these reasons, I will refer to the possibility of agreement with the first and linearly closest disjunct in the VS data as Closest in the following discussion, and treat it as an effect of linear order.

5b. *Furthest or Last?*

The effect of Closest as an agreement strategy in the present study is not surprising in terms of the previous work done on coordinative agreement. The possible effect of Furthest (or possibly Last) as an agreement strategy, however, is indeed surprising, as well as difficult to fit into a theory of hierarchical structure or linear proximity. In a hierarchical approach to order (cf. Munn 2000), the structure of the coordinated DP would involve a BP (Boolean phrase) adjoined to the coordinating DP:

```
              DP1
            /      \
       DP2          BP
                   /    \
                  B      DP3
(10)              or
```
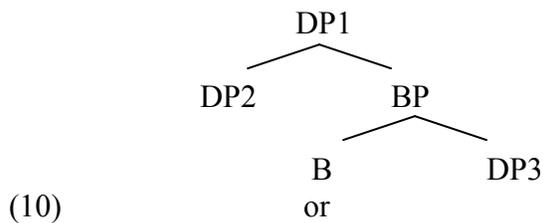
Under this approach, DP1 and DP2 are both possible agreement targets for the governing verb. DP3 is not governed under a standard definition of government, and therefore cannot become a controller for verb agreement. An alternative structure, in which DP3 is higher than DP2, would not allow a quantifier in DP2 to bind a pronoun in DP3. One of Munn's strongest arguments for this structure is that quantifiers in the higher conjunct can bind pronouns in the lower. A standard hierarchical DP structure, then, which is most often posited under X-bar approaches, does not seem compatible with Last agreement.

The alternative is to view this type of agreement as agreement with the furthest conjunct with regard to linear order. Identified linearity effects on agreement (cf. Eggert (2002), Lorimor (2007) and Haskell and Macdonald (2005)) operate exclusively on the most linearly proximate element—the intuitive notion with regard to linear proximity is that

effects dealing with linearly proximate elements do so because of the lower computational cost associated with accessing the nearest element. Because of this, Furthest as a strategy is simply unnatural under this approach.

5c. *A tentative account for the effects of Furthest*

In order to clarify the discussion at this point, I give example sentences demonstrating two of the statistically significant distinctions found in the analysis which motivate the Furthest strategy, with the average judgment across subjects in brackets following:

	(11a)	There	is	a chalkboard or a statue in the next room. [3.98]
			sg.	sg. sg.
vs.	(11b)	There	is	a chalkboard or some statues in the next room. [3.31]
			sg.	sg. pl.

	(12a)	There	are	a chalkboard or some statues in the next room. [2.00]
			pl.	sg. pl.
vs.	(12b)	There	are	a chalkboard or a statue in the next room. [1.50]
			pl.	sg. sg.

In terms of possible strategies (keeping in mind that no convincing evidence was found for Both or Default), (12a) allows Closest and Furthest, while (12b) allows only Closest. Likewise, (12a) allows Furthest, while (12b) represents no strategy at all. Is there any way to maintain this analysis without suggesting Furthest as a strategy?

For this tentative account, I use the following in order to represent the structure of a disjunctive subject DP:

(13)

DP1

DP2   or   DP3

I also assume that number features originating on the DP2 and DP3 may percolate up to the DP1, that the DP1 has a dummy number feature by default (which can syntactically agree with the verb, but cannot translate to a surface representation of verbal morphology) and furthermore that in VS order, the verb may receive its number feature from the DP1. Syntactically, the verb receives its number feature from the DP1, this will

be a 'real' number feature, which has percolated to DP1 from below and is translated to verbal morphology on the surface, or the aforementioned dummy feature, in which case the machinery of the syntax-surface interface, which strictly requires some kind of verbal agreement, will assign number morphology to the verb from the closest possible element with number (in VS order, DP2). This latter outcome represents closest disjunct agreement.

In order for this to correctly predict the distinction between (11a-b) and the distinction between (12a-b), one innovation is required: Number features from DP2 and DP3 may percolate up to DP1 only in the case that they match; otherwise, the number features are discarded, and the dummy feature remains in place, forcing agreement with the linearly proximate element at the surface.

This system would apply to (11a-b) in the following manner, with x representing a dummy number feature.

(14) 11a:

DP1[x] → DP1[sg]

DP2 [sg]   or   DP3 [sg]   DP2 [sg]   or   DP3 [sg]
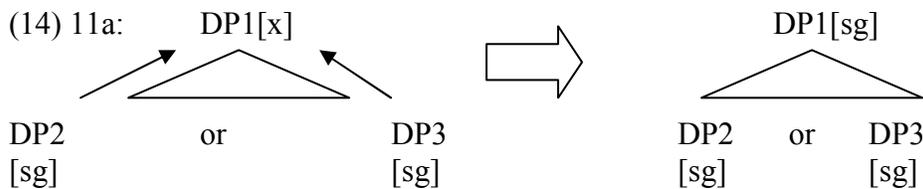
Outcome: Verb gets real number feature along with syntactic agreement with DP1. Surface machinery checks that the verb is marked for number, and finds that it is. Surface machinery also looks at the most linearly proximate element, and find that the number marking there is identical.

(15) 11b:

DP1[x] → DP1[x]

DP2 [sg]   or   DP3 [pl]   DP2 [sg]   or   DP3 [pl]

Outcome: Verb syntactically agrees with DP1, but receives dummy number feature. Surface machinery checks the verb for number marking and finds that it is absent.

Surface machinery marks the verb with the number of the most linearly proximate element, DP2.

What this effectively does is make the number features on both disjuncts, rather than on the most linearly proximate only, visible to the relevant agreement operations only in the case that the disjuncts display a sort of DP concord, i.e. they have identical number features. The redundancy of these agreement options is what accounts for the higher grammaticality judgments on (11a) over (11b). In the case of (12a-b), the grammaticality distinction should not necessarily motivate theoretical changes, because both are considered generally ungrammatical by the subjects of this experiment. The distinction, however, can be made as follows: In (11a), the dummy number feature is left in place on DP1. The dummy feature is passed to the surface machinery, and the surface machinery looks for the linearly proximate number feature, finds DP2, and reports an error because the number of DP2 does not match that of the verb. In (11b), the plural number on the conjuncts matches, and percolates up to DP1. This is passed to the surface machinery, which accepts it, and looks at the most linearly proximate element, which carries the same number. Satisfied with this result, the surface machinery checks these against the verb. Finding multiple violations, the surface machinery reports multiple errors.

5d. *Problem with the tentative account*

The major difficulty in positing this account for the patterns in the data lie in the interaction effect between the Furthest and Number factors found in the ANOVA: The improvement in acceptability afforded by the addition of Furthest as a possible agreement strategy is statistically significant in all but one pairing, which gives a difference that is not even marginally significant. This means that Furthest only reliably improves acceptability in the conditions represented by (11a-b) and (12a-b) above, as well as possibly in (16a-b) below (which is marginally significant; $p<.091$) In (17a-b), while Furthest numerically increases, it is a smaller increase than in the other cases, and not statistically significant ($p<.636$):

> (16a)   There <u>is</u>   <u>some chalkboards</u> or <u>a statue</u> in the next room. [2.26]
>   sg.   pl.   sg.

vs.   (16b)   There <u>is</u>   <u>some chalkboards</u> or <u>some statues</u> in the next room. [1.74]
                          sg.   pl.   pl.

(17a)   There <u>are</u>   <u>some chalkboards</u> or <u>some statues</u> in the next room. [3.64]
                          pl.   pl.   pl.

vs.   (17b)   There <u>are</u>   <u>some chalkboards</u> or <u>a statue</u> in the next room. [3.50]
                          pl.   pl.   sg.

Again, these are comparisons which differ strategy-wise only in the added option of Furthest (available in (16a) and (17a)).

I can offer no concrete reason why the distinction in (17a-b) is not at least marginally significant. While there is no overall preference for plural or singular agreement in the expletive sentence order, the interaction effect found with Furthest and Number (which, as noted in the analysis, may be an artifact of the low number of subjects) signals some relationship in mean variance between the two. A possibility, if a rather indistinct one, is a weak effect of plural preference as found in the SV order in Haskell and Macdonald's (2005) experiment. This effect may not cause significant distinctions otherwise, but may play a role in a situation where plurals abound, obscuring the effects of percolation.

6. Conclusions

As Haskell and Macdonald (2005) demonstrate, the experimental study of verb agreement with disjoint subjects can make fine-grained but meaningful distinctions visible. In this paper, I carry out an experimental study of grammaticality judgments on sentences involving verb agreement with a disjoint subject in order to shed light on the following questions:

       1) Are individual speakers as inconsistent and idiosyncratic in their application of strategies for disjunctive agreement as Morgan and Green (2005) claim?

       2) Given the multiplicity of principles, strategies, and constraints posited in analyses with suboptimal experimental design, which of these are confirmed through more reliable experimental evidence?

       3) Because these strategies are often descriptive in nature, what sort of implications do they have for a mainstream theory of grammar?

The results of the present study suggest the following answers to these questions:

1) While individual speakers may implement idiosyncratic strategies, there remains a statistically significant preference for one version of a sentence over another when those two sentences differ only in terms of verb agreement in number. This finding suggests that a community grammar, or something like it, can be said to exist, even for agreement with disjunctive verbs. With regard to inconsistency, subjects' responses on repeated survey items, when different, primarily indicate an overall shift in the use of the grammaticality scale, rather than the implementation of alternate strategies.

2) In considering six candidate strategies, evidence for the use of two were found in the survey results. The Closest strategy, or agreement with the closest disjunct, was found to be a statistically significant factor in all distinctive cases. Additionally, and much more surprisingly, the Furthest strategy, or agreement with the furthest disjunct, was found to be a statistically significant factor in certain distinctive cases, and several descriptive indicators point to its availability as a strategy for agreement.

3) In terms of theoretical implications, I support Haskell and Macdonald's (2005) discussion of Closest as a strategy which appeals to linear proximity, assuming such linear proximity effects occur outside of a narrowly-defined syntax. In addition, I discuss the inability of syntax or linearity theories to easily accommodate last disjunct agreement and furthest disjunct agreement, respectively. In order to avoid this difficulty, I posit conditional percolation of number features under disjunction to the coordinating DP: in cases where the disjuncts match in number, the number feature of each percolates up to the coordinating DP, yielding a structure which can not only syntactically Agree with the verb, but which can give to the verb a number feature which translates to overt morphology on the surface. In cases where the disjuncts do not match in number, a dummy feature on the coordinating DP syntactically Agrees with the verb, but no number information is passed on to the surface machinery. Without number information from syntax, the surface machinery grants the verb the number morphology which would indicate agreement with the nearest disjunct.

7. Directions for further (and Furthest) research

While the experimental design of the present study has considerable empirical advantages over several previous surveys, there remains room for improvement. In terms of the survey instrument, both Schütze (1996) and Cowart (1997) underscore the importance of counterbalancing, which involves the presentation of survey items to subjects in a different order for each subject or group of subjects. This was not feasible in the present study because of the Internet survey tool used, but it is hoped that an Internet survey tool which allows the re-ordering of items more easily (perhaps one created with this type of experiment in mind) either already exists or will be created. Additionally, it would be helpful to re-test marginally significant cases with a larger number of subjects: the addition of some manner of subject compensation would draw a larger number of subjects. In expanding this survey, I would add further redundancies in verifying that the conditions are, in fact, what they are supposed to be. This is a reasonable measure to avoid a possible error like the one in my master sentence list, which impaired the statistical analysis of the SV data. Finally, given the appropriate resources, a proper context (especially one which favors an inclusive or exclusive reading of *or*) for each experimental item would mitigate certain concerns, and improve the reliability of the experiment.

With regard to the tentative analysis proposed in section 5, independent evidence for such conditional percolation would add viability to the argument. There also exists the possibility that a similar analysis positing privative features (an understanding of features under which only [PL] is an actual feature, and singular is some sort of default) might more closely mirror the experimental findings.

As a final note, it remains unclear whether the common assumption that *and*- and *or*-coordination have the same syntactic structure is warranted. The asymmetry of agreement effects between the two types of coordination suggest that positing a unified analysis which is supported by reliable experimental data will be a difficult undertaking.

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